

Allen-Bradley

Pico DeviceNet Communication Interface

1760-DNET

User Manual

**Rockwell
Automation**

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation sales office or online at <http://www.rockwellautomation.com/literature>) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary we use notes to make you aware of safety considerations.

WARNING



Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

ATTENTION



Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you:

- identify a hazard
 - avoid a hazard
 - recognize the consequence
-

SHOCK HAZARD



Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that dangerous voltage may be present.

BURN HAZARD



Labels may be located on or inside the equipment (e.g., drive or motor) to alert people that surfaces may be dangerous temperatures.

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Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual
- the purpose of this manual
- related documentation
- conventions used in this manual
- Rockwell Automation support

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use Pico controllers.

You should have a basic understanding of electrical circuitry and familiarity with relay logic. If you do not, obtain the proper training before using this product.

Purpose of this Manual

This manual is a reference guide for Pico controllers and the Pico DeviceNet Interface. It describes the procedures you use to install, wire, and troubleshoot the Pico DeviceNet Interface.

Refer to publication 1760-GR001, Pico Controller Getting Results Manual for a basic overview of Pico and an introduction to Pico programming.

Related Documentation

The following documents contain additional information concerning Rockwell Automation products. To obtain a copy, contact your local Rockwell Automation office or distributor.

For	Read this Document	Document Number
A basic overview of Pico and an introduction to Pico programming.	Pico Controller Getting Results Manual	1760-GR001
In-depth information on grounding and wiring Allen-Bradley programmable controllers	Allen-Bradley Programmable Controller Grounding and Wiring Guidelines	1770-4.1
A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices	Application Considerations for Solid-State Controls	SGI-1.1
An article on wire sizes and types for grounding electrical equipment	National Electrical Code - Published by the National Fire Protection Association of Boston, MA.	
A complete listing of current documentation, including ordering instructions. Also indicates whether the documents are available on CD-ROM or in multi-languages.	Allen-Bradley Publication Index	SD499
A glossary of industrial automation terms and abbreviations	Allen-Bradley Industrial Automation Glossary	AG-7.1

Common Techniques Used in this Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.

Rockwell Automation Support

Rockwell Automation offers support services worldwide, with over 75 Sales/Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Rockwell Automation representatives in every major country in the world.

Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Rockwell Automation for technical assistance, please review the Troubleshooting section on page 8-1 in this manual first. Then call your local Rockwell Automation representative.

You can also find a local Rockwell Automation Technical Support contact at:

- <http://support.automation.rockwell.com/contactinformation/>

Your Questions or Comments on this Manual

If you find a problem with this manual, or you have any suggestions for how this manual could be made more useful to you, please contact us at the address below:

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Control and Information Group
Technical Communication, Dept. A602V
P.O. Box 2086
Milwaukee, WI 53201-2086

or visit our internet page at:
<http://www.ab.com/pico> or <http://www.rockwellautomation.com>

Pico DeviceNet Interface

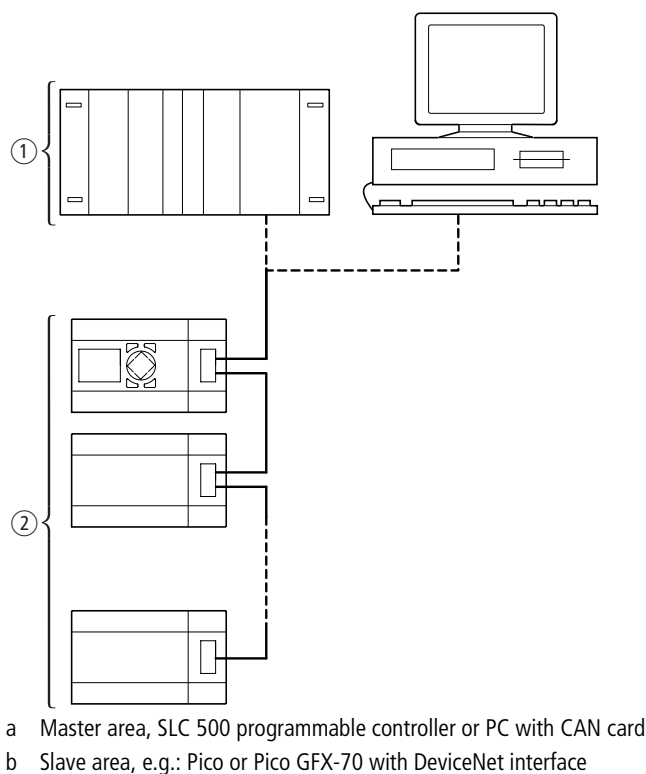
The 1760-DNET communication module has been developed for automation tasks with the DeviceNet field bus. The 1760-DNET acts as a 'gateway' and can only be operated in conjunction with Pico and Pico GFX-70 controllers.

The system unit consists of the Pico control device and the 1760-DNET DeviceNet gateway and operates exclusively as a slave station on the DeviceNet fieldbus system.

System Overview

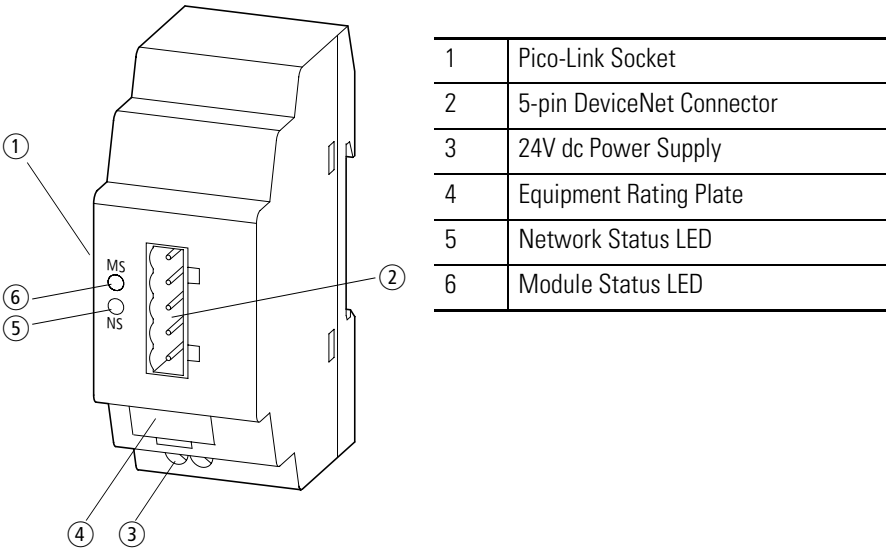
The DeviceNet slaves are integrated into a DeviceNet fieldbus system.

Figure 1.1 Implementation of 1760-DNET in DeviceNet



Structure of the Unit

Figure 1.2



Communication Profile

- Predefined master/slave communication settings
 - The **I/O polling** connection is used for the transfer of 3 bytes of input data (R1 to R16) and 3 bytes of output data (S1 to S8) between the base unit with gateway interconnection and the DeviceNet programmable controller.
 - The **I/O Change of State/Cyclic** connection (acknowledged, unacknowledged) is used to transfer 2 bytes of diagnostic data from the control relay to the DeviceNet programmable controller.
 - The **explicit connection set-up** is used for read/write access to function relay parameters in the control relay. This type of connection set-up also supports the configuration, diagnostics and management services of the control relay.
- DeviceNet Communication adapter profile (device type 12), which has been expanded by requests
- Group 2 server
- UCMM-capable device
- Dynamic set-up of explicit and I/O connections are possible
- Device Heartbeat Message
- Device Shutdown Message
- Offline communication settings

Hardware and Operating System Requirements

The 1760-DNET expansion unit operates together with Pico Series B and Pico GFX-70 controllers.

Use Other Than Intended

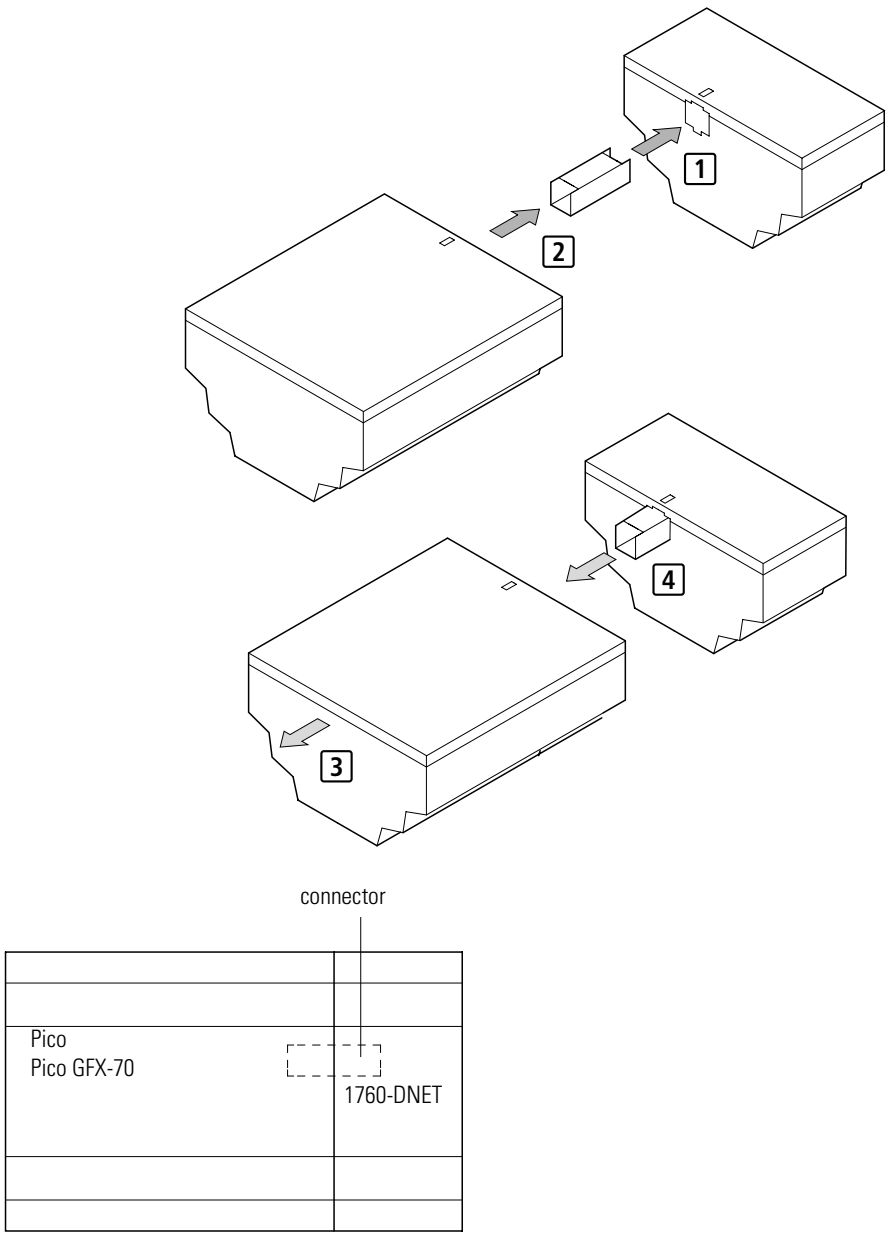
Pico and Pico GFX-70 controllers may not be used to replace safety-relevant control circuits, e.g.:

- Furnace,
- emergency-stop,
- crane or
- Two-hand safety controls.

Installation

Mounting is the same as for Pico Expansion I/O modules.

Connect to the Basic Unit



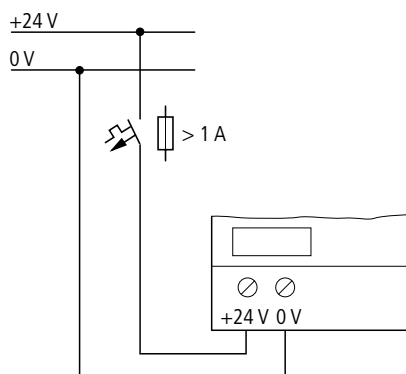
Connect the Power Supply

The module operates with a 24V dc supply voltage (see Power Supply specifications on page A-3).

WARNING



Always ensure safe electrical isolation between the extra low voltage (SELV) and the 24V power supply.

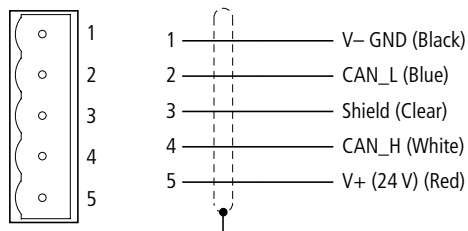


Connect DeviceNet

A 5-pin DeviceNet plug connects the DeviceNet interface of the device to the DeviceNet field bus.

Use a special DeviceNet plug and DeviceNet cable for this connection. Both are specified in the ODVA specification. The type of cable determines the maximum available cable length and the data transfer rate.

DeviceNet Pin Assignment



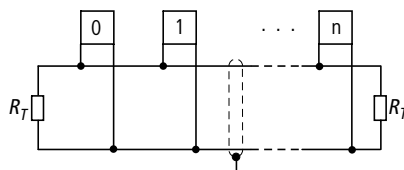
All pins of the plug must be connected to ensure safe communication of the 1760-DNET on the fieldbus DeviceNet. This also applies to the 24V bus voltage.

IMPORTANT

The gateway does not participate in communication on the bus if the bus voltage is not available. The Network status LED is OFF in this situation.

Terminating Resistors

The first and last node of a DeviceNet network must be terminated by means of a $120\ \Omega$ bus termination resistor. This device is interconnected between the CAN_H and CAN_L terminals.



EMC Compatible Wiring

Electromagnetic interference may lead to unwanted effects on the communications fieldbus, which can be significantly reduced by using the cable described above, a shielded RJ45 connector and by terminating the screen.

The two figures below show the correct termination of the shielding.

Figure 1.3 Shield Connection to the Mounting Rail

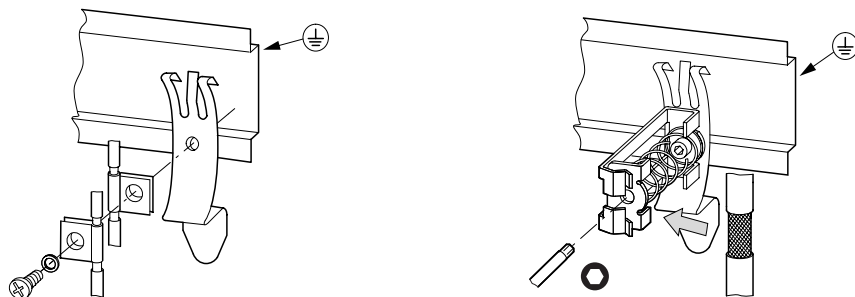
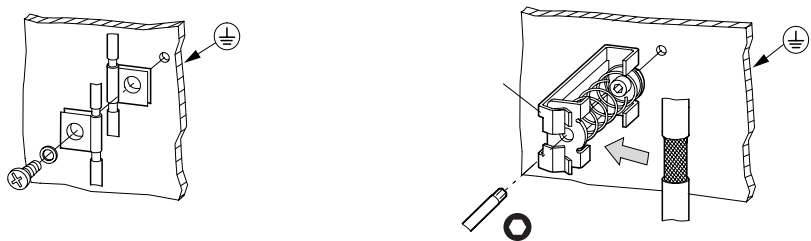
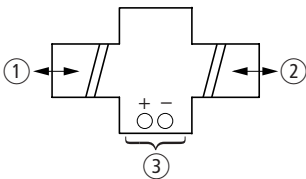


Figure 1.4 Shield Connection to the Mounting Plate



Potential Isolation

The following potential isolation specifications apply to 1760-DNET interfaces:



1	Safe electrical isolation between PicoLink and the 240 VAC mains
2	Simple electrical isolation to the DeviceNet communication bus
3	Power supply 24 V DC

Data Transfer Rates – Automatic Baud Rate Recognition

After it is switched on, the 1760-DNET module automatically detects the data transfer rate of the communication network. However, this is possible only if at least one network node transmits valid message frames. The device supports the following data transfer rates according to ODVA:

- 125 kbps,
- 250 kbps,
- 500 kbps,

Maximum Distances and Bus Cable Lengths

The max. bus length is not determined by the data transfer rate, but rather by the cable used. The following cables are permitted:

- Thin Cable,
- Thick Cable

- or Flat Cable.

The data cable requirements are specified by the ODVA.

Baud Rate (kbps)	Maximum Cable Length (m)		
	Thick Cable	Thin Cable	Flat Cable
125	500	100	420
250	250	100	200
500	100	100	100

Operate the DeviceNet Interface

Initial Power On

Before you apply power to the DeviceNet Interface, verify that it is properly connected to the power supply, to the bus connectors and to the basic unit. Then, switch on the power supply for the basic unit and the DeviceNet Interface.

The LEDs of the 1760-DNET flicker. The device automatically detects the correct baud rate (see Data Transfer Rates – Automatic Baud Rate Recognition on page 2-4). The GW information (intelligent station connected) is displayed on the basic unit.

When the device in the network management is switched to the 'Operational' status, the state of the GW changes to static even on the devices with a flashing GW, (see Network Status LED (NS) on page 3-5).

If the unit has default configuration (node ID = 127), you need to define the DeviceNet slave address.

DeviceNet Setting the Slave Address

Each DeviceNet slave requires a unique address (MAC ID) in the DeviceNet structure. Within a DeviceNet structure, you can assign a maximum of 64 addresses (0 to 63). Each MAC ID must be unique within the entire bus structure.

There are three ways to set the DeviceNet address of an 1760-DNET:

- Using the integrated display and keyboard on the basic unit
- Using Pico-Soft V3.01 or higher on the PC
- Using Pico-Soft Pro on the PC
- Using the configuration software of the installed master programmable controller (possibly by means of an explicit message).

Set the Address on the Controller Unit with Display:

Make sure that:

- The respective basic units and DeviceNet Interface are supplied with voltage.

- The basic unit is accessible (password protection not activated).
- The basic unit has a valid operating system version.
- The basic unit is in STOP mode.



1. Press the DEL + ALT keys to change to the special menu.

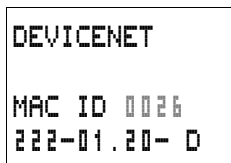
2. Use the cursor keys ^ or v to change to the Configurator.

3. Press OK.

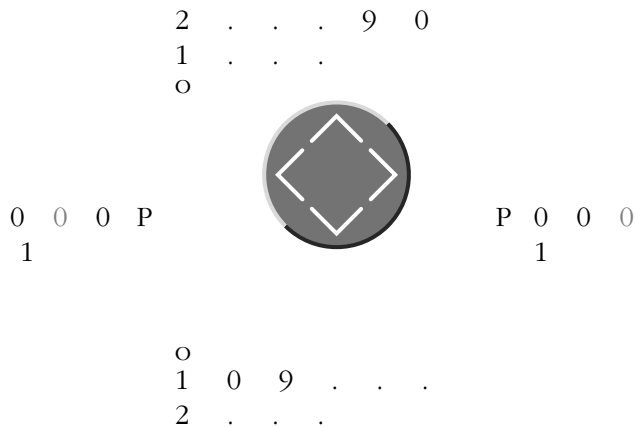
4. Select the LINK.... menu with the Pico-GFX units.

5. Press OK.

The DEVICENET menu appears.



6. Set the address using the cursor keys:
- Set the current numeric value using the ^ or v keys.
 - You can change the current numeric value using < or >.



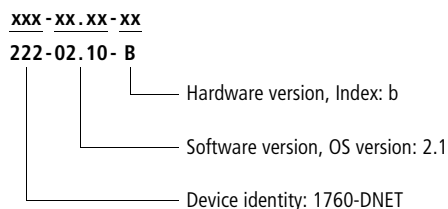


7. Press OK to accept the address.



8. Press ESC to cancel address input.

Information about the 4th display line:



Set the Address with Pico-SOFT

With Pico-SOFT, version 3.1

Menu → Online → Configuration of expansion units

With Pico-SOFT, version 4.01 and later

Menu → Communication → Configuration → Expansion units → 1760-DNET.

IMPORTANT

The menu is only available in the communication view; therefore please activate the 'Communication' tab.

IMPORTANT

After you have modified the MAC ID via the basic unit, restart the DeviceNet Interface by switching power off and on.

Set the Address with the DeviceNet Master

The configuration software supplied with your master programmable controller offers the option of setting or modifying the MAC ID of the gateway.

For more information, refer to the programmable controller's documentation.

You can also use various other software packages to modify the MAC ID by sending an explicit message. Do so by using the corresponding service of the DeviceNet object (see DeviceNet Object on page 4-6).

LED Status Displays

The DeviceNet Interface expansion module is equipped with two indicator LEDs for quick diagnostics. The module monitors itself as well as the DeviceNet communication bus.

Module Status LED (MS)

The dual-color LED (GREEN/RED) indicates the status of the module. It monitors whether the device is fully functional and operates without fault.

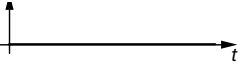
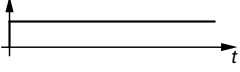
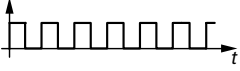

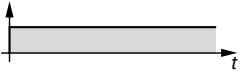

Table 3.1 Module Status LED Description

LED Status	Description	
Off	No power supply at the module.	
Green	The module is in normal operational state.	
Green flashing	The module is in standby mode. The configuration is faulty or incomplete, or a configuration does not exist.	
Red flashing	An error has occurred. There is no need to replace the module.	
Red	A fatal error has occurred. The module must be replaced.	
Green-Red flashing	The module is performing a self-test.	

Network Status LED (NS)

The dual-color LED (GREEN/RED) indicates the status of the DeviceNet communication bus. This function monitors operability and correct operation of the module.

Table 3.2 Network Status LED Description

LED Status	Description	
OFF	The module is offline. Either it is performing a DUP_MAC_ID test or power is missing at the device or bus.	
GREEN flashing	The module is online. Communication has not yet been established.	
GREEN	The module is online and the connection is active.	
RED flashing	Time-out of at least one I/O connection (time-out state).	
RED	A fatal network error has occurred. The module has shut down communication.	
GREEN-RED flashing	The module has detected a network access error and is now in communication error state.	

Cycle Time of the Pico Basic Unit

Network traffic between the Pico basic unit and the DeviceNet Interface via Pico-LINK extends the cycle scan time of the basic unit

In the worst case, this time can be extended by 25 ms.

Please take this factor into account when you calculate the response times of the basic unit.

EDS File

You can implement the module into the DeviceNet structure by means of a standardised EDS file (Electronic Data Sheet).

This EDS file primarily defines the polled I/O connection, the COS I/O connection and the cyclic I/O connection of the gateway. It does not contain data or parameters (Pico object) for functions of the controller. These functions are accessed by means of explicit messages.

You can download updates of the EDS file from:

<http://www.ab.com/networks/eds/>

Search for the catalog number 1760.

IMPORTANT

The Identity Object entry - Major Revision defines the current operating system state of the 1760-DNET communication module. As the device with a newer operating system version can deviate from the EDS description in this point, this entry must be modified accordingly, Identity Object on 4-4.

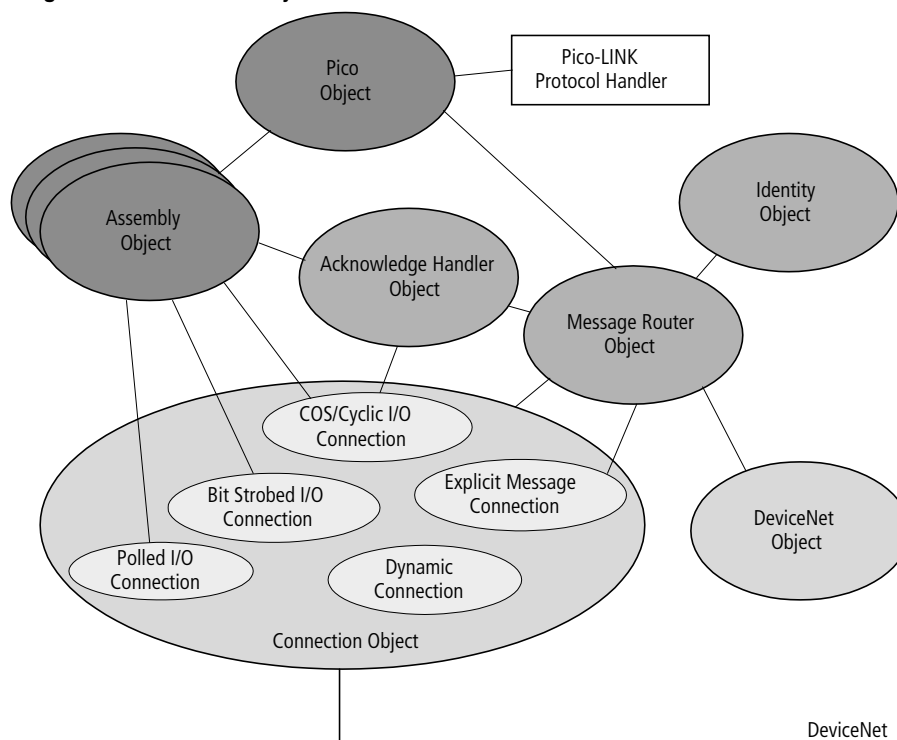
DeviceNet Functions

Object Model

The Pico DeviceNet Interface is based on the Communications Adapter Profile according to the ODVA specifications (Release V2.0).

The DeviceNet object model can be used to describe all 1760-DNET functions. The object model reflects the principle of communication at the application layer. This manual deals in the following only with objects relevant for your application. Primary topic is the manufacturer-specific class Pico object.

Figure 3.5 DeviceNet Objects



The DeviceNet objects in the illustration can be compiled again as 'Management objects', 'Connection objects' and 'Manufacturer-specific objects'.

Table 3.3

Objects	Object Address		Service Address	Function
	Class ID (Hex)	Instance ID (Hex)	(Hex)	Attribute ID (Hex)
Management Objects				
Identity Object	01	01		
Message Router	02	01		
Connection Objects				
DeviceNet Object	03	01		
Connection Object	05	01 ... 04, 04 ... 0F		
Manufacturer-Specific Objects				
Pico Object	64	01		
Direct Access: inputs/outputs, mode				
Read			0E	
Write			10	
Extended access: time, image data, function blocks			32	
Pico Series B				
Pico GFX-70				
Assembly Object	04	64 ... 66		

Management Objects

These objects define DeviceNet-specific data and functions and must be supported by all DeviceNet devices:

- Identity Object

The Identity Object (Class ID 01_{hex}) contains all data for unique identification of a network node, e.g. the Vendor ID, Device Type and Product Code. It also comprises the actual status of a device, the serial number and the product name.

Detailed information can be found on page 4-4.

- Message Router Object

The Message Router Object (Class ID 02_{hex}) provides access to all classes and instances in the device by means of explicit messages.

Connection Objects

These objects define messages exchanged via DeviceNet:

- DeviceNet Object

All devices must support the DeviceNet object (Class ID: 03_{hex}). It defines the physical interconnection of a device to the DeviceNet network, meaning it also contains the device address (MAC ID) and the currently set transmission speed, for example.

Detailed information page 4-6.

- Connection Object

The Connection Object (Class ID: 05_{hex}) is supported by all DeviceNet devices in at least one instance. It defines the access to data via I/O messages or explicit messages, the path and length of producer/consumer data, the CAN connection identifier, the watchdog and the error response.

Manufacturer-Specific Objects

These objects define device-specific data and functions (Application Objects, Parameter Object, Assembly Object).

- Application Objects – Pico Object

Application objects (Class ID: 64_{hex}) describe simple applications for automation engineering. They are either predefined in the DeviceNet object library or by the user.

Refer to Pico Object on page 4-6.

- Assembly Objects

The Assembly Object (Class ID: 04_{hex}) provides the user with mapping options, that is attribute data of different instances in different classes can be grouped together to form a single attribute of an instance in an assembly object.

Identity Object

Object Address		Function	Access
Class ID	Instance ID	Attribute ID	Service Code
01_{hex}	01_{hex}	Table 4.4	Table 4.5

Table 4.4 Attribute IDs of the Identity Object Instance

Attribute ID	Access	Name	Description	Size (byte)
1	Read	Vendor ID	Allen-Bradley Vendor ID = 1	2
2	Read	Device type	The 1760-DNET belongs to the communication adapters category. Its value is 12_{dec} .	2
3	Read	Product code	Allen-Bradley product code = 18410	2

Table 4.4 Attribute IDs of the Identity Object Instance

Attribute ID	Access	Name	Description	Size (byte)
4	Read	Device version	Two bytes are returned when reading the device version.	
		Hardware version,	The low byte defines the hardware version, the high byte the operating system version.	1
		Operating system version		1
5	Read	Status	This attribute describes the global status of the device.	2
6	Read	Serial number	The serial number of the device can be read with this attribute.	4
7	Read	Product name	The product name 1760-DNET is stored as hex value in ASCII format.	12
9	Read	Configuration consistency value	This attribute returns a counter value that monitors the number of modifications in non-volatile memory (E2PROM).	2
10	Read/Write	Heartbeat Interval	Defines an interval between heartbeat messages in [s].	2

Service Code

The Identity Object Instance and also the following instances support the services listed in the table below.

Table 4.5 Service Code

Service Code Value	Service Name	Description
05 _{hex}	Reset	Calls the reset function of the communication module.
0E _{hex}	Get_Attribute_Single	This service can be used to fetch the value of a selected attribute from the communication module.
10 _{hex}	Set_Attribute_Single	This service can be used to set a selected attribute in the device.

DeviceNet Object

Object Address		Function	Access
Class ID	Instance ID	Attribute ID	Service Code
03 _{hex}	01 _{hex}	Table 4.6	Table 4.5

The DeviceNet object instance is used to configure the communication module and to define the physical environment. The Service Codes used for the Identity Object also apply in this case.

Table 4.6 DeviceNet Object Instance Attribute IDs

Attribute ID	Access	Name	Description	Size (byte)
1	Read/Write	MAC ID	The MAC ID represents the network address of a network node. It can be read and set for the module via the DeviceNet fieldbus by means of this attribute. Range of values: 0 to 63 _{dec} . (see DeviceNet Setting the Slave Address on page 3-1)	1
2	Read/Write	Baud rate	This attribute can be used to read/set the data transfer rate for communication functions. Range of values: 0 to 2, 125 to 500 kbps (see Data Transfer Rates – Automatic Baud Rate Recognition on page 2-4).	1
3	Read/Write	BOI (Bus-Off interrupt)	This attribute can be used to define the reaction to a Bus-Off event (CAN-specific).	1
4	Read/Write	Bus-Off counter	This values shows how often a Bus-Off event has occurred. Range of values: 0 to 255.	1

Pico Object

Object Address		Function	Access
Class ID	Instance ID	Attribute ID	Service Code
64 _{hex}	01 _{hex}	Table 4.7	Table 4.8

The Pico object can be used to access Pico/GFX functions via the DeviceNet communication bus . The table below shows the attributes

supported by this object. The two bytes of attributes 1 and 2 provide the diagnostic data of the device. You can use attribute 3 to access the outputs (S1 to S8) and attribute 4 to access the inputs (R1 of R16) of the basic unit.

By using a DeviceNet configuration software (e.g. RSNetworkx), you can map these data directly to the corresponding memory areas of a programmable controller.

Table 4.7

Attribute ID	Access	Name	Description	Size (byte)
1	Read	Pico Status	This attribute can be used to read the status of Pico (RUN or STOP). See Table 4.9.	1
2	Read	Coupling Module Status	This attribute can be used to read the status of Pico-LINK. See Table 4.9.	1
3	Read	Inputs – Send Data	Pico transfers the input data to the DeviceNet bus. The Pico outputs S1 to S8 must be used for this function. The structure of these 3 bytes is described in detail under Input data: Mode, S1 – S8 on page 5-2, .	3
4	Read/W rite	Outputs – Receive Data	The DeviceNet bus transfers the data to Pico. The Pico inputs R1 to R16 must be used for this function. The structure of these 3 bytes is described in detail under Output Data: Mode, R1 – R16 on page 5-4, .	3
5	Read/W rite	Predefined Outputs	This attribute can be used to preset the output data ("R" data) at the 1760-DNET during start-up. The structure of these 3 bytes is described in detail under Output Data: Mode, R1 – R16 on page 5-4.	3

Service Code

The Pico object instance supports the following services.

Table 4.8 Service Code

Service Code Value	Service Name	Description
0E _{hex}	Get_Attribute_Single	This service can be used to fetch the value of a selected attribute from the communication module.
10 _{hex}	Set_Attribute_Single	This service can be used to set a selected attribute in the device.
32 _{hex}	Extended access ⁽¹⁾	This service can be used to address the supplementary parameters ⁽¹⁾ of the control relay:

(1) Additional parameters are "Time", "Image data" and "Function block". Addressing of the parameters is Pico specific and is described in chapters 5 – 7 in detail.
 Extended access is implemented via explicit message transfer. This transfer protocol allows the exchange of control data. Further information about the transfer protocol can be found in section "DeviceNet Communication profile" on page 9.

Change of State I/O Connection

Table 4.9 Diagnostics Data: 2 Byte

Bytes	Meaning	Value	Meaning
0	Pico status (attribute ID 1)	00 _{hex}	Static value.
1	Coupling module status (attribute ID 2)	00 _{hex}	The basic unit is connected to the 1760-DNET gateway via Pico-LINK.
		04 _{hex}	The basic unit is either switched off or disconnected from the 1760-DNET gateway via Pico-LINK.

TIP

When communication between the basic unit Pico/GFX and the expansion unit 1760-DNET goes down, a corresponding error code will be generated in the third data byte. Furthermore, the Rx/Tx data of the gateway will be transferred with the value 00hex.

DeviceNet Communication Profile

DeviceNet is based on a connection-oriented communications model, that is data are exchanged only via the specific connections assigned to the units.

DeviceNet stations communicate either by means of I/O messages or explicit messages.

I/O Messages

I/O messages are used for exchanging high-priority process and application data across the network. Communication between DeviceNet nodes is based on the client/server model, i.e. a "producer" application transfers data to one or several "consumer" applications. It is quite possible in this case that several application objects are addressed in the same unit.

Prerequisite for communication between the units via I/O messages is the implementation of an I/O Messaging Connection Object. You can activate this function in two ways:

- Either by means of a static and in the unit already existing 'I/O connection object' or via the 'Predefined Master/Slave Connection Set', or
- via a dynamically configured 'I/O connection object', which you can configure using an Explicit Messaging Connection Object that already exist in the unit.

Explicit Messages

Explicit messages are used for exchanging low-priority configuration data, general management data or diagnostics data between two specific units across the PtP connection in a client/server system, in which the server always has to acknowledge client requests.

Same as for I/O messaging, the prerequisite for explicit messaging is the implementation of a Connection Object, namely the Explicit Messaging Connection Object. This can be achieved either by activating an existing static connection object in the unit, or via the Predefined Master/Slave Connection Set, or dynamically across the UCMM port (Unconnected Message Manager Port) of a device.

All data of the function relay (Pico basic unit) are processed by means of explicit messages. The DeviceNet master can thus read/write access the parameters of the following functions.

- Time
- Image data
- Function blocks (counters, timers, analog value comparators,...).

General Method of Operation

The general method of operation with the 1760-DNET should be presented in the following. The acyclic data transfer is realised with the aid of explicit messages. The function blocks of the Pico basic unit can be addressed via the service code = 32_{hex}. The assigned attribute ID is here used to distinguish between different parameters and functions.

Service Code	Object Address	
	Class ID	Instance ID
32 _{hex}	64 _{hex}	01 _{hex}

Digression:

DeviceNet based on the standard CAN protocol and therefore uses an 11 bit message identifier. As a result $2^{11} = 2048$ messages (000_{hex} - 7FF_{hex}) are distinguishable. Six bits are sufficient for identification of a device as a DeviceNet network is limited to a maximum of 64 stations. These are referred to as the MAC-ID (device or node address).

Four message groups of differing sizes are available to suit the utilization model.

In DeviceNet language terms the CAN identifier is referred to as the Connection ID. This is comprised of the identifier for the message group (Message ID) and the MAC ID of the device:

- The source and target addresses are possible as the MAC ID; the definition is dependant on the message group and message ID.
- The significance of the message is defined in the system with the message ID.

Four message groups are available in the DeviceNet world. The 1760-DNET uses message group 2. This group uses 512 CAN identifiers (400_{hex} - 5FF_{hex}). Most of the message IDs defined for this group are optional and defined for use of the 'Predefined Master/Slave Connection Sets'. A message ID is used for network management. The priority is primarily determined by the device address and then by the message ID. If the bit position is examined in detail, you will find that a CAN controller with an 8 bit mask is capable of filtering out its group 2 messages.

Connection ID = CAN Identifier										Meaning	
10	9	8	7	6	5	4	3	2	1		0
1	0	MAC ID						Message ID			Message Group 2
1	0	Source MAC ID						0	0	0	Master's I/O Bit-Strobe Command Message
1	0	Source MAC ID						0	0	1	Reserved for Master's Use - Use is TBD
1	0	Destination MAC ID						0	1	0	Master's Change of State or Cyclic Acknowledge Message
1	0	Source MAC ID						0	1	1	Slave's Explicit/Unconnected Response Messages
1	0	Destination MAC ID						1	0	0	Master's Explicit Request Messages
1	0	Destination MAC ID						1	0	1	Master's I/O Poll Command/Change of State/Cyclic Message
1	0	Destination MAC ID						1	1	0	Group 2 Only Unconnected Explicit Request Messages
1	0	Destination MAC ID						1	1	1	Duplicate MAC ID Check Messages

The data transfer on the DeviceNet communication bus is indicated in the following table. The data flow indicates the telegram for reading the date and time in the Pico (see Read/Write Date and Time on page 6-2).

The Pico DeviceNet communication module has MAC ID = 3. It must be noted with the data stream that access is implemented in fragmented form. More information can be found in the ODVA specification.

Description	ID (Hex)	Length	DeviceNet - Byte (Hex)							
			0	1	2	3	4	5	6	7
Master sends a request (Hex) with:	41C	8	80	00	32	64	01	93	05	00
DeviceNet Specific:										
Byte 2 - Service Code = 32 Byte 3 - CLASS ID = 64 Byte 4 - Instance ID = 01										
PicoLINK Specific	41B	3	80	C0	00					
Byte 5 - Attribute ID = 93 Byte 6 - Len = 05 Byte 7 - Index = 0										
Confirmation of the slave (Fragmentation protocol)										

Description	ID (Hex)	Length	DeviceNet - Byte (Hex)							
			0	1	2	3	4	5	6	7
Master sends remaining PicoLINK byte	41C	6	80	01	00	00	00	00		
Byte 2 - Data 1 = 00										
Byte 3 - Data 2 = 00										
Byte 4 - Data 3 = 00										
Byte 5 - Data 4 = 00										
Acknowledgement of the slave (Fragmentation protocol)	41B	3	80	C1	00					
Slave sends a response to the request	41B	8	80	00	B2	C2	05	00	05	09
Byte 3 – response = C2 (read successful)										
Byte 4 – Len = 05										
Byte 5 – Index = 00										
Byte 6 – Data 1 = 05										
Acknowledgement from master (Fragmentation Protocol)	41C	3	80	C0	00					
Slave sends remaining Pico-LINK data:	41B	5	80	81	0D	05	04			
Data 2 = 0D										
Data 3 = 05										
Data 4 = 04										
Acknowledgement from master (Fragmentation protocol)	41C	3	80	C1	00					

Direct Data Exchange with Pico/GFX (Polled I/O Connection)

The DeviceNet master can exchange the following data with the Pico/GFX via the direct cyclic data exchange:

TIP

The terms “input data” and “output data” are used relative to the point of view of the DeviceNet master.

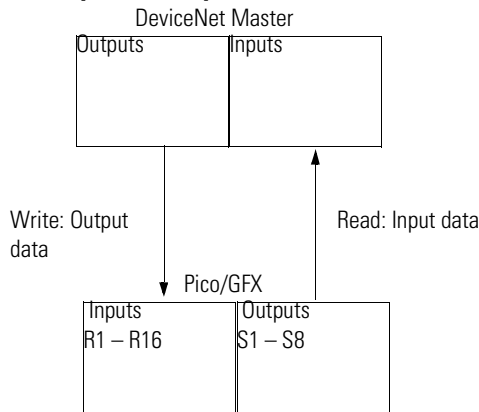
- Write operation
 - Setting or /resetting of the Pico/GFX inputs (R1 to R16)
 - Determination of the RUN/STOP mode.
- Read operation
 - Scanning the output states of the Pico/GFX (S1 to S8)
 - Scanning the mode of the Pico/GFX.

In order to transfer data between the slave 1760-DNET and a DeviceNet master control, you must map the respective cyclic data to the respective slave configuration.

TIP

The interconnection to the DeviceNet controls from Allen Bradley is implemented using an assignment table in the RSNetWorx software tool.

Figure 4.6 Input and Output Data Relative to the DeviceNet Master



**Input data:
Mode, S1 to S8**

Attribute ID: 3

The cyclic data transfer between DeviceNet master and the Pico DeviceNet Interface slave is provided by the input data byte 0, 1 and 2.

IMPORTANT

If Index for transferring valid data is not set, you cannot read the S1 to S8 bits in RSLogix 5000.

Table 5.10 Byte 0 to 2: Input Data, Mode

Byte	Meaning	Value
0	Operating mode scan	
1	Scan status of the Pico outputs S1 to S8	
2	Not used	00hex

The master reads the following data from bytes 0, 1 and 2:

Table 5.11 Byte 0: Operating Mode

Pico Identification	Bit							
	7	6	5	4	3	2	1	0 Stop/Run
Without Input Delay	0	0	0	1	0	0	0	0/1
With Input Delay	0	0	1	0	0	0	0	0/1
Index for transferring valid data	0	0	0	1	0	1	0	0

0 = status '0' 1 = status '1'

Explanation:

Value 14_{hex} = 00010100_{bin}:

Byte 0 must always contain this value if data are to be written to the Pico/GFX basic unit via the 1760-DNET gateway.

EXAMPLE

Value 21_{hex} = 0010 0001_{bin}:

"Pico" is in RUN mode and operates with input delay

Table 5.12 Byte 1: Status of the Pico/GFX outputs S1 to S8

Pico/GFX	Bit							
	7	6	5	4	3	2	1	0
S1								0/1
S2							0/1	
S3						0/1		
S4					0/1			
S5				0/1				
S6			0/1					
S7		0/1						
S8	0/1							

0 = status "0" 1 = status "1"

EXAMPLE

Value 19hex = 0001 1001bin:
S5, S4 and S1 are active

Byte 2: not used

TIP

If control commands and I/O data are used at the same time:

- The inputs will retain their previous state until this control command has been executed.
- The input bytes will be updated again after the data exchange control command has been terminated.

If the status value of the coupling module is invalid (= 04hex), then byte 1 (data byte) is transferred with the value 00hex to the communication bus.

**Output Data:
Mode, R1 – R16**

Attribute ID: 4

The cyclic data transfer between DeviceNet master and the Pico DeviceNet Interface slave is provided by the output data byte 0, 1 and 2.

Table 5.13 Byte 0 to 2: Output Data, Mode

Byte	Meaning	Value
0	Determine mode	
1	Setting/resetting of the Pico/GFX inputs R9 to R16	
2	Setting/resetting of the Pico/GFX inputs R1 to R8	

The master writes the following data to the bytes 0, 1 and 2:

Table 5.14 Byte 0: Operating mode

Pico Operating Mode	Bit							
	7	6	5	4	3	2	1	0
Index for setting the basic unit to safety state	0	0	0	0	0	0	0	0
Index for transferring valid data	0	0	0	1	0	1	0	0
RUN command	0	0	1	1	0	1	0	0
STOP command	0	1	0	0	0	1	0	0

0 = status '0' 1 = status '1'

Explanation:

Value 14_{hex} = 00010100_{bin}:

Byte 0 must always contain this value if data are to be written to the Pico/GFX basic unit via the 1760-DNET gateway.

Value 34_{hex} = 00110100_{bin}:

This value sets the Pico status from STOP to RUN. It is only interpreted as command and therefore does not permit an additional transfer of data. The index value 14_{hex} must be used in this situation.

Value 44_{hex} = 01000100_{bin}:

This value sets the "Pico" status from RUN to STOP. It is also used only as command and is therefore based on the same operating principle as the RUN command.

Value 00_{hex} = 00000000_{bin}:

If this value is written to the control byte, the gateway overwrites the R data with zero. This function is of interest only if a master is to be set to STOP mode and as resultant measure transfers zero values to all I/O in order to ensure safety state.

TIP

Even if the I/O of a control relay can be assigned directly to a specific memory area of the master programmable controller, it is nonetheless important to conform with the correct data structure format (e.g.: input data byte 0 = 14_{hex}).

Table 5.15 Byte 1: Setting/resetting of the Pico/GFX inputs R9 to R16

Pico/GFX	Bit							
	7	6	5	4	3	2	1	0
R9								0/1
R10							0/1	
R11						0/1		
R12					0/1			
R13				0/1				
R14			0/1					
R15		0/1						
R16	0/1							

0 = status '0' 1 = status '1'

EXAMPLE

Value 19hex = 0001 1001bin:

Enable R13, R12 and R9.

Table 5.16 Byte 2: Setting/resetting of the Pico/GFX inputs R1 to R8

Pico/GFX Input	Bit							
	7	6	5	4	3	2	1	0
R1								0/1
R2							0/1	
R3						0/1		
R4					0/1			
R5				0/1				
R6			0/1					
R7		0/1						
R8	0/1							

0 = status '0' 1 = status '1'

EXAMPLE

Value 2Bhex = 0010 1011bin:

Enables R6, R4, R2 and R1.

TIP

If control commands and I/O data are used at the same time:

- The inputs will retain their previous state until this control command has been executed.
- The input bytes will be updated after the data exchange control command has been executed.

Application Examples for Pico

Control commands can be used to initiate data exchange for special services:

- Read/Write Date and Time (page 6-2)
- Read/Write Image Data (page 6-4)
- Read/write function block data (page 6-20).

The DeviceNet master in this case returns to the message transfer protocol of the explicit messages. All parameters are addressed via the Service Code 32_{hex}. The assigned attribute ID is here used to distinguish between different parameters.

Service Code	Object Address	
	Class ID	Instance ID
32 _{Hex}	64 _{Hex}	01 _{Hex}

TIP

The I/O data retain their previously defined state while a control command is being executed. The I/O data will not be updated until data exchange for the control command has been terminated.

IMPORTANT

You may use only the values specified for the instruction code.

Verify data to be transferred in order to avoid unnecessary errors.

A data exchange procedure is required in order to ensure the safe exchange of data via DeviceNet from master to slave and vice versa.

IMPORTANT

The operating mode of the basic unit must correspond with the status indicated at the LEDs when the various parameters are being set.

The master transmits a control command to initiate data exchange between the communication partners. The slave always returns an answer to this request, which indicates whether data has been exchanged or not. An error code will be returned if data exchange has failed. This code is defined in the ODVA specifications. (see Related Documentation on page P-2)

Read/Write Date and Time

Table 6.1 Telegram Structure

Byte		Description	Value (Hex), Sent by	
Master	Slave		Master	Slave
		Attribute ID Read	93	-
		Attribute ID Write	B3	-
	0	Read Successful	-	C2
		Write Successful	-	C1
		Command Rejected	-	C0
0	1	Len	05	05
1	2	Index	0 to 2 ⁽¹⁾	0 to 2 ⁽¹⁾
2 to 6	3 to 7	Data 1 to 5	Depending on index	Depending on index

(1) 0 = Time/date, 1 = Summer time, 2 = Winter time

Table 6.2 Index 0 - Date and Time of Real-Time Clock

Byte		Content	Operand		Value (Hex)
Master	Slave				
2	3	Data 1	Hour	0 to 23	0x00 to 0x17h
3	4	Data 2	Minute	0 to 59	0x00 to 0x3Bh

Table 6.2 Index 0 - Date and Time of Real-Time Clock

Byte		Content	Operand		Value (Hex)
Master	Slave				
4	5	Data 3	Day	Day (1 to 28; 29, 30, 31; depending on month and year)	0x01 to 0x1Fh
5	6	Data 4	Month	1 to 12	0x01 to 0x0Ch
6	7	Data 5	Year	0 to 99 (corresponds to 2000-2099)	0x00 to 0x63h

Table 6.3 Index 1 - Summer Time

Byte		Content		Value (Hex)
Master	Slave			
2	3	Data 1	Area - None	00
			Area - Rule	01
			Area - Automatic EU	02
			Area - Automatic GB	03
			Area - Automatic US	04
for 'Area' = 'Rule'				
3	4	Data 2	Summer time switching rule	
4	5	Data 3		
5	6	Data 4		
6	7	Data 5		

Table 6.4 Index 2 - Winter Time (only valid if Area = Rule selected)

Byte		Content		Value (Hex)
Master	Slave			
2	3	Data 1	Area = Rule	01
3 to 6	4 to 7	Data 2 to 5	Winter Time switching rule	

Switching Rule Bit Array

The following table shows the composition of the corresponding data bytes.

Table 6.5 Switching Rule Bit Array

	Data 5								Data 4								Data 3								Data 2							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Difference			Time of time change												Month			Day			Rule_2		Day		Rule_1						
	0:	0:30h		Minute: 0 to 59								Hour: 0 to 23				0 to 11			0 to 30			0:	month	0:	Su	0:	on					
	1:	1:00h																				1:	after	1:	Mo	1:	on the first					
	2:	1:30h																				2:	before	2:	Tu	2:	on the second					
	3:	2:00h																						3:	We	3:	on the third					
	4:	2:30h																						4:	Thu	4:	on the fourth					
	5:	3:00h																						5:	Fr	5:	on the last					
																								6:	Sa							

Read/Write Image Data

TIP



Refer to the image data provided in the Pico User Manual, 1760-UM001 or in the PicoSoft help.

Overview

Table 6.6 Overview

Operands	Meaning	Read/Write	Type (hex)	Page
A1 – A16	„Analog value comparators/threshold comparators: A1 – A16“	read	8B	6-5
C1 – C16	„Counters: C1 to C16“	read	EE	6-6
D1 – D16	„Text function blocks: D1 – D16“	read	94	6-7
I1 – I16	„Local inputs: I1 – I16“	read	84	6-8
IA1 – IA4	„Local analog inputs: IA1 – IA4“	read	8C	6-9
M1 – M16, N1 – N16	„Write marker: M1 – M16/N1 – N16“	write	86/87	6-10
M1 – M16, N1 – N16	„Read marker: M1 – M16/N1 – N16“	read	86/87	6-11
O1 – O4	„Operating hours counters: O1 – O4“	read	EF	6-13
P1 – P4	„Local P buttons: P1 – P4“	read	8A	6-14

Table 6.6 Overview

Operands	Meaning	Read/Write	Type (hex)	Page
Q1 – Q8	„Local outputs: Q1 – Q8“	read	85	6-15
R1 – R16/ S1 – S8	„Inputs/outputs of PicoLink: R1 – R16/S1 – S8“	read	88/89	6-16
T1 – T16	„Timers: T1 – T16“	read	ED	6-17
Y1 – Y4	„Year time switch: Y1 – Y8“	read	91	6-18
Z1 – Z3	„Master reset: Z1 – Z3“	read	93	6-19
H1 – H4	7-day time switch:  1 –  8	read	90	6-19

Analog value comparators/threshold comparators: A1 – A16

The following commands are used to read the logic state of the individual analog value comparators A1 to A16.

Table 6.7 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	8B	8B
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.8
4	5	Data 2 (Low Byte)	00	Table 6.8
5 – 6	6 – 7	Data 3 – 4	00	00

(1) See Error Codess page 6-34

Table 6.8 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
A1									0/1
A2								0/1	
...					...				
A8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
A9									0/1
A10								0/1	
...					...				
A16		0/1							

Counters: C1 to C16

The following commands are used to read the logic state of the individual counters C1 to C16.

Table 6.9 Telegram Structure

Byte		Meaning	Value (hex) sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	-
	0	Response:		
		Read Successful	-	C2
		Command Rejected	-	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	EE	EE
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.10
4	5	Data 2 (Low Byte)	00	Table 6.10
5 to 6	6 to 7	Data 3 to 4	00	00

(1) Possible causes page 6-34

Table 6.10 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
C1									0/1
C2								0/1	
...					...				
C8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
C9									0/1
C10								0/1	
...					...				
C16		0/1							

Text function blocks: D1 – D16

The following commands are used to read the logic state of the individual text function blocks (D markers).

Table 6.11 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	—
	0	Response:		
		Read successful	—	C2
		Command rejected	—	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	94	94
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.12
4	5	Data 2 (High Byte)	00	Table 6.12
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes page 6-34.

Table 6.12 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
D1									0/1
D2								0/1	
...					...				
D8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
D9									0/1
D10								0/1	
...					...				
D16		0/1							

Local inputs: I1 – I16

This command string enables you to read the local inputs of the Pico basic unit. The relevant input word is stored in Intel format.

Table 6.13 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	—
	0	Response:		
		Read successful	—	C2
		Command rejected	—	C0 ⁽¹⁾
0	1	Len	02	02
1	2	Type	84	84
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.14
4	5	Data 2 (High Byte)	00	Table 6.14
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes <bullets>a page 45

Table 6.14 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
I1									0/1
I2								0/1	
..					..				
I8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
I9									0/1
I10								0/1	
..					..				
I16		0/1							

Local analog inputs: IA1 – IA4

The analog inputs on the Pico basic unit (I7, I8, I11, I12) can be read directly via DeviceNet. The 16-bit value is transferred in Intel format (Low Byte first).

Table 6.15 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	02	02
1	2	Type	8C	8C
2	3	Index	00 – 03 ⁽²⁾	00 – 03 ⁽²⁾
3	4	Data 1 (Low Byte)	00	Table 6.16
4	5	Data 2 (High Byte)	00	Table 6.16
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes <bullets>a page 45

(2) 00 = Analog input I7
 01 = Analog input I8
 02 = Analog input I11
 03 = Analog input I12

Example:

A voltage signal is present at analog input 1. The required telegrams for reading the analog value are as follows:

Table 6.16 Example Telegram for Reading the Value at the Analog Input

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response: read successful	–	C2
0	1	Len	02	02
1	2	Type	8C	8C
2	3	Index	02 ⁽¹⁾	02 ⁽¹⁾
3	4	Data 1	00	4B
4	5	Data 2	00	03
5	6	Data 3	00	00
6	7	Data 4	00	00

(1) 02 = Analog input I11

Byte 4 – Data 1 (Low Byte): 4B_{hex}

Byte 5 – Data 2 (High Byte): 03_{hex}

→ corresponding 16-bit value: 034B_{hex} = 843

The value 843 corresponds to the 10 bit value of the analog converter.
The following conversion is required for the actual analog value:

$$\frac{10V}{1023} \times 10\text{bit} \longrightarrow \frac{10V}{1023} \times 843 = 8.24V$$

Write marker: M1 – M16/N1 – N16

Table 6.17 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Write	8C	–
	0	Response:		
		Write successful	–	C1

Table 6.17 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Command rejected	–	C0 ⁽³⁾
0	1	Len	01	01
1	2	Type ⁽¹⁾		
		With M marker	86	86
		With N marker	87	87
2	3	Index ²	00 – 0F	00 – 0F
3	4	Data 1 (Low Byte) ⁽²⁾	00/01	00/01
4 – 6	5 – 7	Data 2 – 4	00	00

(1) There are 16 M markers and 16 N markers. The markers are addressed by Type and Index: Use Type to select the M or N marker. Use Index to select the marker number.

(2) The marker is set if a value is written to the data byte that does not equal zero. The marker is reset accordingly if the value 0 is written to data byte Data 1.

(3) Possible causes page 6-34

Table 6.18 Marker M13 is Set

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Write	8C	–
	0	Response:		
		Write successful	–	C1
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type		
		M marker	86	86
2	3	Index	0C	0C
3	4	Data 1	01	00
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-49

Read marker: M1 – M16/N1 – N16

Unlike the write operation, the marker read operation reads the entire marker area of a particular marker type (M or N) is read.

Table 6.19 Telegram Structure

Byte Master	Slave	Meaning	Value (hex), sent by	
			Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽²⁾
0	1	Len	01	01
1	2	Type		
		M marker	86	86
		N marker	87	87
2	3	Index ⁽¹⁾	00	00
3	4	Data 1 (Low Byte)	00	Table 6.20
4	5	Data 2 (Low Byte)	00	Table 6.20
5 – 6	6 – 7	Data 3 – 4	00	00

(1) There are 16 M markers and 16 N markers. The markers are addressed by Type and Index: Use Type to select the M or N marker. Use Index to select the marker number

(2) Possible causes page 6-34

Table 6.20 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1		Bit	7	6	5	4	3	2	1	0
m	N									
M1	N1									0/1
M2	N2								0/1	
...				
M8	N8		0/1							
Data 2		Bit	7	6	5	4	3	2	1	0
M9	N9									0/1
M10	N10								0/1	
...	–					...				
M16	N16		0/1							

Table 6.21 The N Markers are Read

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type		
		N marker	87	87
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	04
4	5	Data 2 (Low Byte)	00	84
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes <bullets>a page 49

The markers N3, N11 and N16 are set.

Operating hours counters: 01 – 04

The following commands are used to read the logic state of the operating hours counters 01 – 04.

Table 6.22 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	EF	EF
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.23
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-34

Table 6.23 Byte 3 (master) or byte 4 (slave): Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
01									0/1
02								0/1	
03							0/1		
04						0/1			
...					

Local P buttons: P1 – P4

The local P buttons are the display cursor buttons of the Pico basic unit. You can scan the buttons in both RUN and STOP mode.

IMPORTANT

Ensure that the P buttons are also activated via the System menu (in the basic unit).

Only one byte has to be transferred for the P buttons.

Table 6.24 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	8A	8A
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.25
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-348

Table 6.25 Byte 3 (master) or byte 4 (slave): Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
P1									0/1
P2								0/1	
P3							0/1		
P4						0/1			
–					0				
–				0					
–			0						
–		0							

Example:

Data 1 = 2_{hex} → P3 is active.

Local outputs: Q1 – Q8

The local outputs can be read directly via the DeviceNet fieldbus.

Table 6.26 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	85	85
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.27
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causespage 6-34

Table 6.27 Byte 4: Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
Q1									0/1

Table 6.27 Byte 4: Data 1

Q2								0/1	
..					..				
Q8		0/1							

Example:

Data 1 = 52_{hex} → Q2, Q5 and Q7 are active.

Inputs/outputs of PicoLink: R1 – R16/S1 – S8

This service allows you to read the local R and S data and the data of the NET stations (1 – 8) transferred via PicoLink, again from the relevant Pico image.

Table 6.28 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type		
		for R data	88	88
		for S data	89	89
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.29
4	5	Data 2 (Low Byte)	00	Table 6.29
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes page 6-34

Table 6.29 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1		Bit	7	6	5	4	3	2	1	0
RW	SW									
R1	S1									0/1
R2	S2								0/1	
...				

Table 6.29 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

R8	S8		0/1							
Data 2		Bit	7	6	5	4	3	2	1	0
R9	—									0/1
R10	—								0/1	
...	—					...				
R16	—		0/1							

Timers: T1 – T16

The following commands are used to read the logic state of the individual timers T1 - T16.

Table 6.30 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	—
	0	Response:		
		Read successful	—	C2
		Command rejected	—	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	ED	ED
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.31
4	5	Data 2 (Low Byte)	00	Table 6.31
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Possible causes page 6-34

Table 6.31 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
T1									0/1
T2								0/1	
...					...				
T8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
T9									0/1

Table 6.31 Byte 3 to 4 (master) or Byte 4 to 5 (slave): Data 1 to 2

T10								0/1	
...					...				
T16		0/1							

Year time switch: Y1 – Y8

The following commands are used to read the logic state of the individual year time switches.

Table 6.32 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	91	91
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.33
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-34

Table 6.33 Byte 3 (master) or byte 4 (slave): Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
HY1									0/1
HY2								0/1	
HY3							0/1		
HY4						0/1			
HY5					0				
HY6				0					
HY7			0						
HY8		0							

Example:

Data 1 = 1_{hex} → HY2 is active

Master reset: Z1 – Z3

Table 6.34 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	93	93
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.35
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-34

Table 6.35 Byte 3 (master) or byte 4 (slave): Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
Z1 for Q outputs									0/1
Z2 for M markers								0/1	
Z3 for outputs and markers							0/1		
...		0	0	0	0	0			

7-day time switch: 01 – 08

The following commands are used to read the logic state of the individual 7-day time switches.

Table 6.36 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	88	–
	0	Response:		
		Read successful	–	C2

Table 6.36 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Command rejected	–	C0 ⁽¹⁾
0	1	Len	01	01
1	2	Type	90	90
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.37
4 – 6	5 – 7	Data 2 – 4	00	00

(1) Possible causes page 6-34

Table 6.37 Byte 3 (master) or byte 4 (slave): Data 1

Data 1	Bit	7	6	5	4	3	2	1	0
HW1									0/1
HW2								0/1	
HW3							0/1		
HW4						0/1			
HW5					0				
HW6				0					
HW7			0						
HW8		0							

Example:

Data 1 = 2_{hex} → 03 is active.

Read/write function block data

IMPORTANT

Refer to the Pico User Manual, 1760-UM001 for information on function blocks.

General notes

Always note the following when working with function blocks:

- The relevant data is transferred in Intel format. In other words, the first byte is the low byte (Byte 5) and the last byte (byte 8) the high byte.

- The maximum data length is 4 bytes. All values must be transferred in hexadecimal format.

Overview

Table 6.38 Overview

Operands	Meaning	Read/Write	Type (hex)	Page
A1 – A16	„Analog value comparator/threshold comparator: A1 – A16“	Read/Write	8D	21
C1 – C16	„Counter relays: C1 – C16“	Read/Write	8F	23
O1 – O4	„Operating hours counters: O1 – O4“	Read/Write	92	25
T1 – T16	„Timing relays: T1 – T16“	Read/Write	8E	27
Y1 – Y8	„Year time switch: Y1 – Y8“	Read/Write	A2	30
Ø1 – Ø8	7-day time switch: Ø1 – Ø8	Read/Write	A1	32

Analog value comparator/threshold comparator: A1 – A16

Table 6.39 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	8D	8D
1	2	Instance ⁽¹⁾	00 – 0F	00 – 0F
2	3	Index	Table 6.40	Table 6.40
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.41	depending on index, Table 6.41

(1) Pico provides 16 analog comparators A1 to A16 for use as required. These can be addressed using the instance (0 – F).

(2) Possible causes page 6-34

Table 6.40 Operand overview

Index (hex)	Operand		Read	Write
00	Parameters Table 6.41		x	
01	Control byte Table 6.42		x	
02	Comparison value 1	I1 ⁽¹⁾	x	c ⁽²⁾
03	Comparison value 2	I2 ⁽¹⁾	x	c ⁽²⁾
04	Gain factor for I1 (I1 = F1 × I1)	F1 ⁽¹⁾	x	c ⁽²⁾
05	Gain factor for I2 (I2 = F2 × I2)	F2 ⁽¹⁾	x	c ⁽²⁾
06	Offset for value I1 (I1 = OS + actual value at I1)	OS ⁽¹⁾	x	c ⁽²⁾
07	Switching hysteresis for value I2	HY ⁽¹⁾	x	c ⁽²⁾

(1) A 16-bit value is transferred in data bytes Data 1 – Data 2. It should be remembered that the low byte 1 is in Data 1 (Byte 5) and the high byte 2 (byte 8) in Data 2.

Example: 5327dec = 14CFhex | Data 1 = 0xCF, Data 2 = 0x14

(2) The value can only be written if it is assigned to a constant in the program.

Table 6.41 Index 00 – Parameters

Meaning	Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Appears in the parameter menu																	
Yes/no																	0/1
Compare																	
FB not used														0	0	0	
EQ (=)														0	0	1	
GE (\geq)														0	1	0	
LE (\leq)														0	1	1	
GT (>)														1	0	0	
LT (<)														1	0	1	
Use as constant and therefore can be written to																	
I1= Constant													0/1				
F1= Constant												0/1					
I2= Constant											0/1						
F2 = Constant										0/1							
OS = Constant									0/1								
HY = Constant								0/1									
Not used		0	0	0	0	0	0										

Example:

Data 1 (Byte 4) = 0xA3, Data 2 (Byte 5) = 0x03

→ Resulting 16-bit value = 03A3_{hex}

Meaning: HY, OS, F2, F1 are assigned a constant; I1, I2 are assigned to a variable such as I7, I8 C2...etc., appears in the Parameter menu;

The output of the analog value comparator is active for as long as the comparison $(I1 \times F1) + OS = (I2 \times F2) + HY$ is fulfilled.

Table 6.42 Index 01 – Control byte

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽¹⁾

(1) Status 1 if comparison condition is fulfilled.

Counter relays: C1 – C16

Table 6.43 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	8F	8F
1	2	Instance ⁽¹⁾	00 – 0F	00 – 0F
2	3	Index	Table 6.44	Table 6.44
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.45	depending on index, Table 6.45

(1) Pico provides 16 counters C1 to C16 for use as required. These can be addressed using the instance (0 – F).

(2) Possible causespage 6-34

Table 6.44 Operand overview

Index (hex)	Operand		Read	Write
00	Parameters Table 6.45		x	
01	Control byte Table 6.46		x	
02	Process variable	S ₁ ⁽¹⁾	x	c ⁽²⁾
03	Counter setpoint 2	S ₂ ⁽¹⁾	x	c ⁽²⁾

(1) A 16-bit value is transferred in data bytes Data 1 – Data 2. It should be remembered that Data 1 is the low byte and Data 2 the high byte.

(2) The value can only be written if it is assigned to a constant in the program.

Table 6.45 Index 00 – Parameters

Meaning	Bit	7	6	5	4	3	2	1	0
Appears in the parameter menu									
Yes/no									0/1
Counter mode									
FB not used							0	0	
Up/down counter (N)							0	1	
High-speed up/down counter (H)							1	0	
Frequency counter (F)							1	1	
Use as constant and therefore can be written to									
Counter setpoint S1						0/1			
Unused bits		–	–	–	–				

Example:

Data 1 (Byte 4) = 0x07

Meaning:

The values appear in the Parameter menu. The counter is used in the mode of the frequency meter. The counter setpoint 1 is not assigned to a constant and cannot therefore be written to.

Table 6.46 Index 01 – Control byte

Data 1	Bit	7	6	5	4	3	2	1	0
FB output		–	–	–	–	C ⁽¹⁾	RE ⁽²⁾	D ⁽³⁾	Q1 ⁽⁴⁾

(1) Count coil, counts on every rising edge

(2) Reset, the timing relay is reset (reset coil)

(3) Count direction: 0 = up counting, 1 = down counting

(4) Switch contact

Table 6.47 C3 Value to Read

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Command: Read	89	–
	0	Response: read successful	–	C2
0	1	Type	8F	8F
1	2	Instance	02	02
2	3	Index	02	02
3	4	Data1	00	12
4	5	Data 2	00	03
5	6	Data 3	00	00
6	7	Data 4	00	00

Explanation:

Data 1 = 12

Data 2 = 03

→ resulting 16-bit value = $0312_{\text{hex}} = 786_{\text{dec}}$

Counter status = 786

Operating hours counters: 01 – 04

Table 6.48 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	92	92

Table 6.48 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
1	2	Instance ⁽¹⁾	00 – 03	00 – 03
2	3	Index	Table 6.49	Table 6.49
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.50	depending on index, Table 6.50

(1) Pico provides 4 operating hours counters 01 to 04. These can be addressed using the instance (0 – 3).

(2) Possible causes page 6-34

Table 6.49 Operand overview

Index (hex)	Operand		Read	Write
00	Parameters Table 6.50		x	
01	Control byte Table 6.51		x	
02	Process variable	S1 ⁽¹⁾	x	c ⁽²⁾
03	Counter setpoint 2	S2 ²	x	c1

(1) A 32-bit value is transferred in data bytes Data 1 – Data 4. It should be remembered that the Data 1 is the low byte and Data 4 the high byte.

(2) The value can only be written if it is assigned to a constant in the program.

Table 6.50 Index 00 – Parameters

Meaning	Bit	7	6	5	4	3	2	1	0
Appears in the parameter menu									
Yes/no									0/1
Use in the program									
Setpoint S1								0/1	
Unused bits		–	–	–	–	–	–		

Example:

Data 1 (Byte 4) = 0x01

Meaning:

The values appear in the Parameter menu.

Table 6.51 Index 01 – Control byte

Data 1	Bit	7	6	5	4	3	2	1	0
FB output		–	–	–	–	–	RE ⁽¹⁾	EN ⁽²⁾	Q1 ⁽³⁾

(1) Reset, the timing relay is reset (reset coil)

(2) Enable, the timing relay is started (trigger coil)

(3) Switch contact

Example:

Index 02/03

Transferred values: Data 1 0x21

Data 2 0x23

Data 3 0x40

Data 4 0x00

Resulting value: 00402321_{hex} = 4203297_{dec}

Timing relays: T1 – T16

Table 6.52 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	8E	8E
1	2	Instance ⁽¹⁾	00 – 0F	00 – 0F
2	3	Index	Table 6.53	Table 6.53
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.54	depending on index, Table 6.54

(1) Pico provides 16 timing relays T1 to T16 for use as required. These can be addressed using the instance (0 – F).

(2) Possible causes page 6-34

Table 6.53 Operand overview

Index (hex)	Operand		Read	Write
00	Parameters Table 6.54		x	
01	Control byte Table 6.55		x	
02	Actual value 1	T	x	c ⁽²⁾
03	Time setpoint 1	S1 ⁽¹⁾	x	c ⁽²⁾
04	Time setpoint 2	S2 ⁽¹⁾	x	c ⁽²⁾

(1) A 16-bit value is transferred in data bytes Data 1 – Data 2. It should be remembered that Data 1 is the low byte and Data 2 the high byte.

(2) The value can only be written if it is assigned to a constant in the program.

Table 6.54 Index 00 – Parameters

Meaning	Bit	7	6	5	4	3	2	1	0
Appears in the parameter menu									
Yes/no									0/1
Timer mode									
On-delayed,						0	0	0	
off-delayed.						0	0	1	
On-delayed with random setpoint						0	1	0	
Off-delayed with random setpoint						0	1	1	
On and off delayed (two time setpoints)						1	0	0	
On and off delayed each with random setpoint (two time setpoints)						1	0	1	
Impulse transmitter						1	1	0	
Flashing relay (two time setpoints)						1	1	1	
Timebase									
FB not used				0	0				
Millisecond: S				0	1				
Second: M:S				1	0				
Minute: H:M				1	1				
Use as constant and therefore can be written to									
Time setpoint S1			0/1						
Time setpoint S2		0/1							

Example:

Data 1 (Byte 4) = 0xAC

Meaning:

The values appear in the Parameter menu. The time is used in the impulse transmitter mode with the Second time base. The time setpoint S1 is assigned a constant and the time setpoint S2 is assigned a variable such as I7, I8 C2...etc.

Table 6.55 Index 01 – Control byte

	Bit	7	6	5	4	3	2	1	0
FB input/output Data 3		–	–	–	–	ST ⁽¹⁾	RE ⁽²⁾	EN ⁽³⁾	Q1 ⁽⁴⁾

(1) Stop, the timing relay is stopped (Stop coil)

(2) Reset, the timing relay is reset (reset coil)

(3) Enable, the timing relay is started (trigger coil)

(4) Switch contact

Table 6.56 Read Time Setpoint 1

Byte	Meaning	Value (hex), sent by	
		Master	Slave
0	Command: Read	89	–
	Response: read successful	–	C2
1	Type	8E	8E
2	Instance	00	00
3	Index	03	03
4	Data1	00	4C
5	Data 2	00	06
6	Data 3	00	00
7	Data 4	00	00

Explanation:

Data 1 = 4C

Data 2 = 06

→ resulting 16-bit value = 064C_{hex} = 1612_{dec}

Table 6.57 Set Time

millisecond	s	16120 ms	16.120 s
Seconds	M:S	1620 s	26:52 Minutes
Minute	H:M	1612 min	67:04 Hours

Year time switch: Y1 – Y8

Table 6.58 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	A2	A2
1	2	Instance ⁽¹⁾	00 – 07	00 – 07
2	3	Index	Table 6.59	Table 6.59
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.60	depending on index, Table 6.60

(1) Pico provides 8 year time switches Y1 to Y8 for use as required. These can be addressed using the instance (0 – 7).

(2) Possible causes page 6-34

Table 6.59 Operand overview

Index (hex)	Operand	Read	Write
00	Parameters Table 6.60	x	
01	Control byte Table 6.61	x	
	Channel A	x	c ⁽¹⁾
11	Time point ON	x	c ⁽¹⁾
12	Time point OFF	x	c ⁽¹⁾
	Channel B	x	c ⁽¹⁾
21	Time point ON	x	c ⁽¹⁾
22	Time point OFF	x	c ⁽¹⁾
	Channel C	x	c ⁽¹⁾
31	Time point ON	x	c ⁽¹⁾
32	Time point OFF	x	c ⁽¹⁾

Table 6.59 Operand overview

Index (hex)	Operand	Read	Write
	Channel D	x	c ⁽¹⁾
41	Time point ON	x	c ⁽¹⁾
42	Time point OFF	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

In the data bytes Data 1 – Data 3 the switching points are transferred.

Table 6.60 Index 00 – Parameters

Meaning	Bit	7	6	5	4	3	2	1	0
Appears in the parameter menu									
Channel A									0/1
Channel B								0/1	
Channel C							0/1		
Channel D						0/1			
Unused bits		–	–	–	–				

Example:

Data 1 (Byte 4) = 0x03 → The values for the year time switch of channels A and B appear in the parameter menu.

Table 6.61 Index 01 – Control byte

Data 1	Bit	7	6	5	4	3	2	1	0
FB output		–	–	–	–	–	–	–	Q1 ⁽¹⁾

(1) Status 1 if count condition is fulfilled.

Channel A, index 11/12

Index 0x11 channel A timepoint of switch on

Index 0x12 channel A timepoint of switch off

Data 1 (Byte 4) – day

Data 2 (Byte 5) – month

Data 3 (Byte 6) – year

Example:

The year time switch channel A should be switched on at the 21.04.2004.

Index = 0x11
 Data 1 = 0x15
 Data 2 = 0x04
 Data 3 = 0x04

The year time switch channel B should be switched off on the 05.11.2012.

Index = 0x22
 Data 1 = 0x05
 Data 2 = 0x0B
 Data 3 = 0x0C

7-day time switch: 01 – 08

Table 6.62 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	89	–
		Write	8D	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0 ⁽²⁾
0	1	Type	A1	A1
1	2	Instance ⁽¹⁾	00 – 07	00 – 07
2	3	Index	Table 6.63	Table 6.63
3 – 6	4 – 7	Data 1 – 4	depending on index, Table 6.64	depending on index, Table 6.64

(1) Pico provides 8 week time switches 01 to 08 for use as required. These can be addressed using the instance (0 – 7).

(2) Possible causes <bullets>a page 41

Table 6.63 Operand overview

Index (hex)	Operand		Read	Write
00	Parameters Table 6.64		x	
01	Control byte Table 6.65		x	
11	Channel A	Day on/off	x	c ⁽¹⁾
12		Time on	x	c ⁽¹⁾
13		Time off	x	c ⁽¹⁾
21	Channel B	Day on/off	x	c ⁽¹⁾
22		Time on	x	c ⁽¹⁾
23		Time off	x	c ⁽¹⁾
31	Channel C	Day on/off	x	c ⁽¹⁾
32		Time on	x	c ⁽¹⁾
33		Time off	x	c ⁽¹⁾
41	Channel D	Day on/off	x	c ⁽¹⁾
42		Time on	x	c ⁽¹⁾
43		Time off	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

TIP

A 16-bit value is transferred in data bytes Data 1 – Data 4. It should be remembered that Data 1 is the low byte and Data 2 the high byte.

Table 6.64 Index 00 – Parameters

Meaning	Bit	7	6	5	4	3	2	1	0
Appears in the parameter menu									
Channel A									0/1
Channel B								0/1	
Channel C							0/1		
Channel D						0/1			
Unused bits		–	–	–	–				

Example:

Data 1 (Byte 4) = 0x03

Meaning:

The values of the 7-day timer switch WH.. of channel A and B appear in the parameter menu.

Table 6.65 Index 01 – Control byte

Data 1	Bit	7	6	5	4	3	2	1	0
FB output		–	–	–	–	–	–	–	Q1 ⁽¹⁾

(1) Status 1 if count condition is fulfilled.

Channel A, index 11/12/13

Index 0x11 channel A day on/off

Data 1 (Byte 4) – day on

Data 2 (Byte 5) – day off

0x01 = Sunday ... 0x07 = Saturday

If the channel is not used the 16 bit value is equal to 0x00.

Index 0x12 – time on (2 bytes)

Index 0x13 – time off (2 bytes)

Data 1 (Byte 4) – hour

Data 2 (Byte 5) – minute

Example: time on at 13:43

Data 1 = 0x0D

Data 2 = 0x2B

Analysis – error codes via PicoLink

The Pico basic unit will return a defined error code in the event of an incorrectly selected operating mode or an invalid telegram. The error code transferred has the following structure:

Table 6.66 Telegram Structure

Byte	Meaning	Slave transmits (value hex)
0	Answer	
	Command rejected	C0
1	Type	00
2	Instance	00
3	Index	00
4	Error code	Table 6.67

Table 6.67 Error codes

Error code	Description
0x01	An unknown telegram has been sent.
0x02	An unknown object has been sent.
0x03	An unknown command has been sent.
0x04	An invalid instance has been sent.
0x05	An invalid parameter set has been used.
0x06	An attempt has been made to write a variable which is not a constant.
0x0C	The device is in an invalid device mode. STOP → RUN or RUN → STOP
0x0D	An invalid display access occurs. Please exit the menu level to allow the status display to be shown on the display. Writing to the clock is not possible.
0xF0	An attempt has been made to control an unknown parameter.
0xF1	Invalid value

Pico GFX Control Commands

Control commands can be used to initiate data exchange for special services:

- Read/write date and time (page 7-2)
- Read/write image data (page 7-7)
- Read/write function block data (page 7-20)

The DeviceNet master in this case falls back upon the message transfer protocol of the explicit messages. All parameters are addressed via the Service Code 32_{hex}. The assigned attribute ID is here used to distinguish between different parameters.

Service code	Object address	
	Class ID	Instance ID
32 _{hex}	64 _{hex}	01 _{hex}

TIP

The I/O data retain their previously defined state while a control command is being executed. The I/O data will not be updated until data exchange for the control command has been terminated.

IMPORTANT

You may use only the values specified for the instruction code.

Verify data to be transferred in order to avoid unnecessary errors.

A data exchange procedure is required in order to ensure the safe exchange of data via DeviceNet from master to slave and vice versa.

TIP

The operating mode of the basic unit must correspond with the status indicated at the LEDs when the various parameters are being set.

The master transmits a control command to initiate data exchange between the communication partners. The slave always returns an answer to this request, which indicates whether data has been exchanged or not. An error code will be returned if data exchange has failed. This code is precisely defined in the ODVA specifications.

Version history

The following table provides an overview of modifications and new features of the different Pico device versions:

Effect on PicoLink	Pico GFX device version		
	From 02	From 04	From 05
Support for complete PDO access			
R data writable	j	j	j
S data readable	j	j	j
Support for complete SDO access			
Function blocks	–	MR, A, AR, BV, C, CF, CH, CI, CP, D, DB, GT, HW, HY, OT, PT, SC, T, BC, BT, DC, FT, LS, NC, PW, ST, VC	
Image data			
Read	–	IW, IA, ID, QW, QA, P, RW, SW, M, MB, MW, MD	
Write	–	QW, QA, M, MB, MW, MD	M, MB, MW, MD
Clock functions	–	j	j
Rule option for winter/summer (DST) time change	–	–	j

Read/write date and time

TIP

Refer to real-time clock information in publication 1760-UM001.

Table 6.68 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	93	–
		Write	B3	–
	0	Answer		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Len	05	05
1	2	Index	00	00
2 – 6	3 – 7	Data 1 – 5		
		Read operation	00	Table 6.69
		Write operation	Table 6.69	00

Table 6.69 Byte 2 to 6 (master) or Byte 3 to 7 (slave): Data 1 to 5

Byte		Content	Operand		Value (hex)
Master	Slave				
2	3	Data 1	Hour	0 to 23	00 – 17
3	4	Data 2	Minute	0 to 59	00 – 3B
4	5	Data 3	Day	Day (1 to 28; 29, 30, 31 ; depending on month and year)	01 – 1F
5	6	Data 4	Month	1 to 12	01 – 0C
6	7	Data 5	Year	0 to 99 (corresponds to 2000-2099)	00 – 63

Winter/summer time, DST

Table 6.70 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	93	–
		Write	B3	–
	0	Answer		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Len	05	05
1	2	Index		
		01: Summer/Winter time	Table 6.71	Table 6.71
		02: Winter time (to the “Area” = rule”) ⁽¹⁾	Table 6.72	Table 6.72
2 – 6	3 – 7	Data 1 – 5		
		Read operation	00	depending on index, Table 6.71 and Table 6.72
		Write operation	depending on index, Table 6.71 and Table 6.72	00

(1) Detailed setting possibilities for Pico GFX from version 05

Table 6.71 Index 01 – Summer/Winter time switchover

Byte		Content		Value (hex)
Master	Slave			
2	3	Data 1	Area	
			None	00
			Manual	01
			Automatic EU	02
			Automatic GB	03
			Automatic US	04
			Rule ⁽¹⁾	05
for “Area” = “manual”:				
3	4	Data 2	Set summer time day (1 to 28, 29, 30, 31 depending on month and year).	00 – 3B
4	5	Data 3	Set Summer time month (1 to 12)	01 – 1F
5	6	Data 4	Set winter time day (1 to 28, 29, 30, 31 depending on month and year)	01 – 0C
6	7	Data 5	Set Winter time month (1 to 12)	00 – 63
for “Area” = “Rule” ⁽¹⁾ :				
3 – 6	4 – 7	Data 2 – 5	Summer time switching rule	Table 6.73

(1) Detailed setting possibilities for Pico GFX from version 05

Table 6.72 Index 02 – Winter time (only valid if Area = "Rule" selected)

Byte		Content		Value (hex)
Master	Slave			
2	3	Data 1	Area = Rule	01
3 – 6	4 – 7	Data 2 – 5	Winter time switching rule	Table 6.73

Switching rule bit array

TIP

Refer to 1760-UM002 for more information. The following table shows the composition of the corresponding data bytes.

Table 6.73 Switching Rule Bit Array

	Data 5								Data 4								Data 3								Data 2							
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Rule_1			Day		Rule_2		Day				Month			Time of time change								Difference									
	0:	on		0:	Su	0:	month		0 to 30				0 to 11			Hour: 0 to 23				Minute: 0 to 59				0:	0:30h							
	1:	on the first		1:	Mo	1:	after																	1:	1:00h							
	2:	on the second		2:	Tu	2:	before																	2:	1:30h							
	3:	on the third		3:	We																			3:	2:00h							
	4:	on the fourth		4:	Thu																			4:	2:30h							
	5:	on the last		5:	Fr																			5:	3:00h							
				6:	Sa																											

Example

The real-time clock of the Pico GFX is to be set to Friday 23.05.2003, 14:36.

Table 6.74

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Write	B3	—
	0	Response: Write successful	—	C1
0	1	Len	05	05
1	2	Index	00	00
2	3	Data 1 (hex)	0E	00
3	4	Data 2 (minute)	24	00
4	5	Data 3 (day)	17	00
5	6	Data 4 (month)	05	00
6	7	Data 5 (year)	03	00

TIP

All values must be transferred as hexadecimal values.

Read/write image data

Overview

Table 6.75

Operands	Meaning	Read/Write	Command (hex)	Page
IA1 – IA4	"Local analog inputs: IA1 – IA4"	read	02	7
ID1 – ID16	"Local diagnostics: ID1 – ID16"	read	03	9
IW0	"Read local inputs: IW0"	read	01	10
IW1 – IW8	"Inputs of the network station: IW1 – IW8"	read	01	11
M...	"Marker: M.."	read/write	0B – 0E	12
P1 – P4	"Local P buttons: P1 – P4"	read	06	15
QA1	"Local analog output: QA1"	read/write	05	16
QW0, QW1 – QW8	"Local outputs: QW0/ outputs of the network station: QW1 – QW8"	read/write	04	17
R1 – R16	"Inputs/outputs of PicoLink: RW/SW"	read	07/09	18
S1 – S8				
RN1 – RN32	"Receive data network: RN1 – RN32/ Send data network: SN1 – SN32"	read	08/0A	19
SN1 – SN32				

Local analog inputs: IA1 – IA4

The analog inputs on the Pico GFX and GFX basic units can be read directly via DeviceNet. The 16-bit value is transferred in Intel format (Low Byte first).

Table 6.76 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0

Table 6.76 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
0	1	Len	02	02
1	2	Type	02	02
2	3	Index	01 – 04 ⁽¹⁾	01 – 04 ⁽¹⁾
3	4	Data 1 (Low Byte)	00	→ example on page 7-8
4	5	Data 2 (High Byte)	00	
5 – 6	6 – 7	Data 3 – 4	00	00

(1) 01 = Analog input I7
 02 = Analog input I8
 03 = Analog input I11
 04 = Analog input I12

Example

A voltage signal is present at analog input 1. The required telegrams for reading the analog value are as follows:

Table 6.77

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response: Read successful	–	C2
0	1	Len	02	02
1	2	Type	02	02
2	3	Index	01 ⁽¹⁾	01 ¹
3	4	Data 1	00	D9
4	5	Data 2	00	02
5	6	Data 3	00	00
6	7	Data 4	00	00

(1) 01 = Analog input 1

Byte 4 – Data 1 (Low Byte): D9_{hex}

Byte 5 – Data 2 (High Byte): 02_{hex}

→ corresponding 16-bit value: 02D9_{hex} = 729 (7.29 V)

Local diagnostics: ID1 – ID16

The local diagnostics (ID1 – ID8) bytes indicate the status of the individual NET stations. The connection to the remote station (only GFX) is indicated via ID9.

Table 6.78 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	03	03
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.79
4	5	Data 2 (High Byte)	00	Table 6.79
5 – 6	6 – 7	Data 3 – 4	00	00

Table 6.79 Byte 4 to 5: Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
ID1									0/1
ID2								0/1	
..					..				
ID8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
ID9									0/1
–								1	
...					...				
–		1							

TIP

0/1 indicates active/inactive NET station,
– indicates not assigned

Example

Data 1 = F8, Data 2 = FF → In the Pico-NET network, the three stations are present with the NET IDs 1, 2, 3

Read local inputs: IWO

This command string enables you to read the local inputs of the Pico GFX. The relevant input word is stored in Intel format.

Table 6.80 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	01	01
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.81
4	5	Data 2 (High Byte)	00	Table 6.81
5 – 6	6 – 7	Data 3 – 4	00	00

Table 6.81 Byte 4 to 5: Data 1 to 2

Data 1	Bit	7	6	5	4	3	2	1	0
I1									0/1
I2								0/1	
..					..				
I8		0/1							
Data 2	Bit	7	6	5	4	3	2	1	0
I9									0/1
I10								0/1	
..					..				
I16		0/1							

Table 6.82 Read Local Inputs IW0

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response: Read successful	–	C2
0	1	Len	02	02
1	2	Type	01	01
2	3	Index	00	00
3	4	Data 1	00	C4
4	5	Data 2	00	02
5	6	Data 3	00	00
6	7	Data 4	00	00

TIP

All values must be transferred as hexadecimal values.

The values Data 1 = C4 and Data 2 = 02 indicate that the inputs I8, I7, I3 and I10 have been set to 1.

Inputs of the network station: IW1 – IW8

The Pico GFX and GFX devices can be remotely expanded very simply using the PicoNET. The service offered here makes it possible to implement read access to the inputs of individual NET stations.

Table 6.83 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Len	02	02

Table 6.83 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
1	2	Type	01	01
2	3	Index	01 – 08 ⁽¹⁾	01 – 08 ⁽¹⁾
3	4	Data 1 (Low Byte)	00	Table 6.81
4	5	Data 2 (High Byte)	00	
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Corresponds to address of network station

Marker: M..**Table 6.84**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	91	–
		Write	B1	–
	0	Answer		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Len	Table 6.85	Table 6.85
1	2	Type		
2	3	Index		
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	Example 1: Set/reset market bit on page 7-14
		Write operation	Example 2: Write marker word on page 7-14	00

Table 6.85 Byte 0 to 2 (master) or: Byte 1 to 3 slave: Len, Type, Index

Operand		Len	Type	Index
Marker bit	M1...M96	01 _{hex}	0B _{hex}	01 to 60 _{hex}
Marker byte	MB1...MB96	01 _{hex}	0C _{hex}	01 to 60 _{hex}
Marker word	MW1...MW96	02 _{hex}	0D _{hex}	01 to 60 _{hex}
Marker double word	MD1...MD96	04 _{hex}	0E _{hex}	01 to 60 _{hex}

If required, refer to the more detailed description of the marker allocation in the Pico GFX manual. Only a small extract of this manual is shown at this point in order to illustrate the allocation principle.

ATTENTION

The function blocks and DW markers (32-bit values) of Pico GFX operate with signed values.

Table 6.86

Applies to MD, MW, MB, M	Left = Most significant bit, byte, word			Right = Least significant bit, byte, word
32 bit	MD1			
16 bit	MW2		MW1	
8 bit	MB4	MB3	MB2	MB1
1 bit	M32 to M25	M24 to M17	M16 to M9	M8 to M1
32 bit	MD2			
16 bit	MW4		MW3	
8 bit	MB8	MB7	MB6	MB5
1 bit	M64 to M57	M56 to M49	M48 to M41	M40 to M33

TIP

The relevant marker values are transferred in Intel format. In other words, the first byte is the low byte (Byte 4) and the last byte the high byte.

Example 1: Set/reset marker bit

Marker bit 62 should be set or reset. Write a “1” to set or a “0” to reset the marker bit in the least significant bit of data byte “Data 1”.

*Example 2: Write marker word***Table 6.87**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Write	B1	–
	0	Response: Write successful	–	C1
0	1	Len	01	01
1	2	Type	0B	0B
2	3	Index	3E	3E
3	4	Data 1	010 ⁽¹⁾	00
4 – 6	5 – 7	Data 2 – 4	00	00

(1) 01 = set, 00 = reset

The value 823 should be written into the marker word MW32: $823_{\text{dec}} = 337_{\text{hex}} \rightarrow \text{Data 1} = 37_{\text{hex}}, \text{Data 2} = 03_{\text{hex}}$

Table 6.88

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Write	B1	–
	0	Response: Write successful	–	C1
0	1	Len	01	01
1	2	Type	0D	0D
2	3	Index	20	20
3	4	Data 1	37	00
4	5	Data 2	03	00
5	6	Data 3	00	00
6	7	Data 4	00	00

Local P buttons: P1 – P4

The local P buttons are the display cursor buttons of the Pico GFX basic unit. You can scan the buttons in both RUN and STOP mode.

TIP

Ensure that the P buttons are also activated via the SYSTEM menu (in the basic unit).

Only one byte has to be transferred for the P buttons.

Table 6.89

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	06	06
2	3	Index	00	00
3	4	Data 1 (Low Byte)	00	Table 6.90
4 – 6	5 – 7	Data 2 – 4	00	00

Table 6.90 Byte 4: Data

Data 1	Bit	7	6	5	4	3	2	1	0
P1									0/1
P2								0/1	
P3							0/1		
P4						0/1			
–					0				
–				0					
–			0						
–		0							

Local analog output: QA1

The commands provided can be used to access the local analog output of the Pico GFX or GFX basic unit. When writing to the analog output (only possible from Pico GFX, device version 04) the value will only be output if the respective device is in RUN mode and if the respective image is not written by the actual program, <bullets>a section “Read/write image data” on page 7.

Table 6.91

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	91	–
		Write⁽¹⁾	B1	–
	0	Answer		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	05	05
2	3	Index	00	00
3 – 4	4 – 5	Data 1 – 2		
		Read operation	00	see example below
		Write operation	see example below	00
5 – 6	6 – 7	Data 3 – 4	00	00

(1) Writing is only possible from Pico GFX, version 0.4, see page 7-2.

Example:

The analog output should output a value of approx. 5 V.

500 = 01F4_{hex} Byte 4 – Data 1 (LowByte) : F4_{hex}

Byte 5 – Data 2 (HighByte): 01_{hex}

Local outputs: QW0/ outputs of the network station: QW1 – QW8

The local outputs can be read directly via DeviceNet, and from Pico GFX version 04 they can also be written. However, the outputs are only switched externally if the device is in Run mode and the addressed output is not being used in the circuit diagram. Refer to Read/write image data on page 7-7.

Table 6.92 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	91	–
		Write⁽¹⁾	B1	–
	0	Answer		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	04	04
2	3	Index ⁽²⁾	00/01 – 08	00/01 – 08
3	4	Data 1		
		Read operation	00	Table 6.81
		Write operation	Table 6.93	00
4 – 6	5 – 7		00	00

(1) Writing is only possible from Pico GFX, device version 04 see Read/write data and time on page 7-2..

(2) 00 = Local output 01 – 08 = Outputs of network stations 1 – 8

Table 6.93 Byte 4: Data

Data 1	Bit	7	6	5	4	3	2	1	0
Q1									0/1
Q2								0/1	
Q3							0/1		
Q4						0/1			
Q5					0				

Table 6.93 Byte 4: Data

Q6				0					
Q7			0						
Q8		0							

Inputs/outputs of PicoLink: RW/SW

This service allows you to read the local R and S data and the data of the NET stations (1 – 8) transferred via PicoLink, again from the relevant Pico GFX image.

Table 6.94

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
		Response:		
	0	Read successful	–	C2
		Command rejected	–	C0
0	1	Len	02	02
1	2	Type	For RW: 07	For RW: 07
2			For SW: 09	For SW: 09
	3	Index	00/01 – 08 ⁽¹⁾	00/01 – 08 ⁽¹⁾
3	4	Data 1 (Low Byte)	00	Table 6.95
4	5	Data 2 (High Byte)	00	Table 6.95
5 – 6	6 – 7	Data 3 – 4	00	00

(1) 00 = Local input/output 01 – 08 = Address of network station (NET-ID 1 – 8)

Table 6.95 Byte 4 to 5: Data 1 to 2

Data 1		Bit	7	6	5	4	3	2	1	0
RW	SW									
R1	S1									0/1
R2	S2								0/1	
R3	S3							0/1		
R4	S4						0/1			
R5	S5					0/1				

Table 6.95 Byte 4 to 5: Data 1 to 2

R6	S6				0/1					
R7	S7			0/1						
R8	S8		0/1							
Data 2		Bit	7	6	5	4	3	2	1	0
R9	–									0/1
R10	–								0/1	
R11	–							0/1		
R12	–						0/1			
R13	–					0/1				
R14	–				0/1					
R15	–			0/1						
R16	–		0/1							

Receive data network: RN1 – RN32/ Send data network: SN1 – SN32

PicoNET allows a point-to-point connection to be implemented between the individual NET stations. The RN and SN data are used for the data exchange (see publication 1760-UM002).

TIP

The RN SN data of the local device (Index = 0) to which the module is fitted cannot be scanned. In this case the command would be denied with the 0Chex signal.

Table 6.96

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	91	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Len	04	04
1	2	Type	For RN1 – RN32: 08	For RN1 – RN32: 08

Table 6.96

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
			For SN1 – SN32: 0A	For SN1 – SN32: 0A
2	3	Index	01 – 08 ⁽¹⁾	01 – 08 ⁽¹⁾
3 – 6	4 – 7	Data 1 – 4	00	Table 6.97

(1) Corresponds to NET-ID

Table 6.97 Byte 4 to 7: Data 1 to 4

Data 1		Bit	7	6	5	4	3	2	1	0
RN1	SN1					...				0/1
...									0/1	
RN8	SN8		0/1							
Data 2		Bit	7	6	5	4	3	2	1	0
RN9	SN9									0/1
....						...				
RN16	SN16		0/1							
Data 3		Bit	7	6	5	4	3	2	1	0
RN17	SN17									0/1
...						...				
RN24	SN24		0/1							
Data 4		Bit	7	6	5	4	3	2	1	0
RN25	SN25									0/1
...						...				
RN32	SN32		0/1							

Read/write function block data

Always note the following when working with function blocks:

- The relevant data is transferred in Intel format. In other words, the first byte is the low byte (Byte 4) and the last byte (byte 7) the high byte.
- The maximum data length is 4 bytes. All values must be transferred in hexadecimal format.
- All 32-bit values are treated as signed values. When transferring 32-bit values, ensure that the appropriate value range is suitable for long integers, i.e. signed.
32-bit value: –2147483648 .. 0 .. +2147483647

Overview

Table 6.98

Operands	Meaning	Read/Write	Type (hex)	Page
A01 – A32	“Analog value comparator: A01 – A32”	Read/Write	11	7-22
AR01 – AR32	“Arithmetic function block: AR01 – AR32”	Read/Write	12	7-23
BC01 – BC32	“Block Compare: BC01 – BC32”	Read/Write	25	7-25
BT01 – BT32	“Block Transfer: BT01 – BT32”	Read/Write	26	7-27
BV01 – BV32	“Boolean operation: BV01 – BV32”	Read/Write	13	7-28
C01 – C32	“Counter: C01 – C32”	Read/Write	14	7-30
CF01 – CF04	“Frequency counters: CF01 – CF04”	Read/Write	15	7-32
CH01 – CH04	“High-speed counter: CH01 – CH04”	Read/Write	16	7-33
CI01 – CI02	“Incremental encoder counters: CI01 – CI02”	Read/Write	17	7-35
CP01 – CP32	“Comparator: CP01 – CP32”	Read/Write	18	7-36
D01 – D32	“Text output function block: D01 – D32”	Read/Write	19	7-38
DB01 – DB32	“Data block: DB01 – DB32”	Read/Write	1A	7-40
DC01 – DC32	“PID controller: DC01 – DC32”	Read/Write	27	7-41
FT01 – FT32	“Signal smoothing filter: FT01 – FT32”	Read/Write	28	7-43
GT01 – GT32	“Receipt of network data: GT01 – GT32”	Read	1B	7-45
HW01 – HW32	“7-day time switch: HW01 – HW32”	Read	1C	7-46
HY01 – HY32	“Year time switch: HY01 – HY32”	Read	1D	7-49
LS01 – LS32	“Value scaling: LS01 – LS32”	Read/Write	29	7-51
MR01 – MR32	“Master reset: MR01 – MR32”	Read	0F	7-52
NC01 – NC32	“Numerical converter: NC01 – NC32”	Read/Write	A 2	7-53
OT01 – OT04	“Hours-run meters: OT01 – OT04”	Read/Write	1E	7-55
PT01 – PT32	“Sending of network data: PT01 – PT32”	Read	1F	7-56
PW01 – PW02	“Pulse width modulation: PW01 – PW02”	Read/Write	2B	7-58
SC01	“Synchronize clock function block: SC01”	Read	20	7-59
ST01	“Set cycle time function block: ST01”	Read/Write	2C	7-60
T01 – T32	“Timing relays: T01 – T32”	Read/Write	21	7-61
VC01 – VC32	“Value limitation: VC01 – VC32”	Read/Write	2D	7-63

Analog value comparator: A01 – A32

Table 6.99 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	11	11
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.100	Table 6.100
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.101 and 6.102

Table 6.100 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.101		x	
01	Mode, Table 6.102		x	
02	Comparison value 1	I1	x	c ⁽¹⁾
03	Gain factor for I1 (I1 = F1 × value)	F1	x	c ⁽¹⁾
04	Comparison value 2	I2	x	c ⁽¹⁾
05	Gain factor for I2 (I2 = F2 × value)	F2	x	c ⁽¹⁾
06	Offset for value I1	OS	x	c ⁽¹⁾
07	Switching hysteresis for value I2 (the value of HY is for both positive and negative hysteresis.)	HY	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 7 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.101 Index 0 – Bit I0

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	CY ⁽¹⁾	Q1 ⁽²⁾

(1) Status 1 if the value range is exceeded

(2) Status 1 if the condition is fulfilled (e.g. I1 < I2 with LT mode)

Table 6.102 Index 1 - Mode

Data 1 (hex)		
00	LT	Less than (I1 < I2)
01	EQ	Equal to (I1 = I2)
02	GT	Greater than (I1 > I2)

Arithmetic function block: AR01 – AR32**Table 6.103 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	12	12
1	2	Instance	01 – 20	01 – 20

Table 6.103 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
2	3	Index	Table 6.104	Table 6.104
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.105 and 6.106
		Write operation	depending on index, Table 6.105 and 6.106	00

Table 6.104 Operand overview

Index (hex)	Operand		read	write
00	Bit I0, Table 6.105		x	
01	Mode, Table 6.106		x	
02	First operand	I1	x	c ⁽¹⁾
03	Second operand	I2	x	c ⁽¹⁾
04	Result	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 4 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.105 Index 0 – Bit I0

	Bit	7	6	5	4	3	2	1
FB output Data 3		–	–	–	–	–	ZE ⁽¹⁾	CY ⁽²⁾

(1) Status 1 if the value of the function block output QV (the calculation result) equals zero

(2) Status 1 if the value range is exceeded

Table 6.106 Index 1 - Mode

Data 1 (hex)		
00	ADD	Add ($I1 + I2 = QV$)
01	SUB	Subtract ($I1 - I2 = QV$)
02	MUL	Multiply ($I1 \times I2 = QV$)
03	DIV	Divide ($I1 : I2 = QV$)

Block Compare: BC01 – BC32**Table 6.107 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	25	25
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.108	Table 6.108
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.109 and 6.110
		Write operation	depending on index, Table 6.109 and 6.110	00

Table 6.108 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.109		x	
01	Mode, Table 6.110		x	
02	Source range 1	I1	x	c ⁽¹⁾
03	Target range 2	I2	x	c ⁽¹⁾
04	Number of elements to compare: 8 (max. 192 bytes)	NO	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 4 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.109 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	EN ⁽⁴⁾
FB output Data 3		–	–	–	–	EQ ⁽¹⁾	E3 ⁽²⁾	E2 ⁽³⁾	E1 ⁽⁵⁾

(1) Status 1 if the data ranges are equal; status 0 if not equal

(2) Status 1 if the number of elements exceeds the source or target range.

(3) Status 1 if the source and target range overlap.

(4) Activates the function block on status 1.

(5) Status 1 if the source or target range are outside of the available marker range (offset error)

Table 6.110 Index 1 - Mode

Mode	Data 1 (hex)	Mode
	02	Compare (internal status signal for Block Compare mode)

Block Transfer: BT01 – BT32

Table 6.111 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	26	26
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.112	Table 6.112
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.113, 6.114
		Write operation	depending on index, Table 6.113, 6.114	00

Table 6.112 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.113		x	
01	Mode, Table 6.114		x	
02	Source range 1	I1	x	c ⁽¹⁾
03	Target range 2	I2	x	c ⁽¹⁾
04	Number of elements to compare: max. 192 bytes	N0	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 and 3 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte .. Data 2 – High Byte).

Table 6.113 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	T ⁽³⁾
FB output Data 3		–	–	–	–	–	E3 ⁽¹⁾	E2 ⁽²⁾	E1 ⁽⁴⁾

(1) Status 1 if the number of elements exceeds the source or target range.

(2) Status 1 if the source and target range overlap.

(3) Transfer of the source address specified at I1 to the target address specified at I2 on rising edge.

(4) Status 1 if the source or target range are outside of the available marker range (offset error)

Table 6.114 Index 1 - Mode

Data 1 (hex)	Mode
00	INI: Initialises the target range with a byte value stored at the source address.
01	CPY: Copies a data block from a source to a target range. Data block size is specified at NO.

Boolean operation: BV01 – BV32

Table 6.115 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	13	13
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.116	Table 6.116

Table 6.115 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.117 and 6.118
		Write operation	depending on index, Table 6.117 and 6.118	00

Table 6.116 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.117		x	
01	Mode, Table 6.118		x	
02	First operand	I1	x	c ⁽¹⁾
03	Second operand	I2	x	c ⁽¹⁾
04	Operation result	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 4 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.117 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1
FB output Data 3		–	–	–	–	–	–	ZE ⁽¹⁾

(1) Status 1 if the value of the function block output QV (the operation result) equals zero

Table 6.118 Index 1 - Mode

Data 1 (hex)		
00	AND	And sequence

Table 6.118 Index 1 - Mode

Data 1 (hex)		
01	OR	Or sequence
02	XOR	Exclusive Or sequence
03	NET	Inverts the individual bits of the value at I1. The inverted value is represented as a signed decimal value.

Counter: C01 – C32**Table 6.119 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	14	14
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.120	Table 6.120
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.121
		Write operation	depending on index, Table 6.121	00

Table 6.120 Operand overview

Index (hex)	Operand		Value	read	write
00	Bit IO		Table 6.121	x	
01	Mode/Parameter		–	–	–

Table 6.120 Operand overview

Index (hex)	Operand		Value	read	write
02	Upper setpoint	SH	In integer range from –2147483648 to +2147483647	x	C ⁽¹⁾
03	Lower setpoint	SL		x	C ⁽¹⁾
04	Preset actual value	SV		x	C ⁽¹⁾
05	Actual value in Run mode	QV		x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 5 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.121 Index a0 – Bit I0

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	SE ⁽¹⁾	D ⁽³⁾	C ⁽⁵⁾	RE ⁽⁷⁾
FB output Data 3		–	–	–	–	ZE ⁽²⁾	CY ⁽⁴⁾	FB ⁽⁶⁾	OF ⁽⁸⁾

(1) Transfer preset actual value on rising edge

(2) Zero: Status 1 if the value of the function block output QV (the counter status) equals zero

(3) Count direction: 0 = up counting, 1 = down counting

(4) Carry: Status 1 if the value range is exceeded

(5) Count coil, counts on every rising edge

(6) Fall below: Status 1 if the actual value F lower setpoint

(7) Reset actual value to zero

(8) Overflow: Status 1 if the actual value f upper setpoint

Frequency counters: CF01 – CF04

Table 6.122 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	15	15
1	2	Instance	01 – 04	01 – 04
2	3	Index	Table 6.123	Table 6.123
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.124
		Write operation	depending on index, 6.124	00

Table 6.123 Operand overview

Index (hex)	Operand		read	write
00	Bit I0, Table 6.124		x	
01	Mode/Parameter		–	–
02	Upper setpoint	SH	x	c ⁽¹⁾
03	Lower setpoint	SL	x	c ⁽¹⁾
04	Actual value in Run mode	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 4 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.124 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	EN ⁽³⁾
FB output Data 3		–	–	–	–	–	ZE ⁽¹⁾	FB ⁽²⁾	OF ⁽⁴⁾

(1) Zero: Status 1 if the value of the function block output QV (the counter status) equals zero

(2) Fall below: Status 1 if the actual value F lower setpoint

(3) Counter enable

(4) Overflow: Status 1 if the actual value f upper setpoint

High-speed counter: CH01 – CH04

Table 6.125 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	16	16
1	2	Instance	01 – 04	01 – 04
2	3	Index	Table 6.126	Table 6.126
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.127
		Write operation	depending on index, Table 6.127	00

Table 6.126 Operand overview

Index (hex)	Operand		Value	read	write
00	Bit I/O		Table 6.127	x	
01	Mode/Parameter		—	—	—
02	Upper setpoint	SH	In integer range from –2 147 483 648 to +2 147 483 647	x	c ⁽¹⁾
03	Lower setpoint	SL		x	c ¹
04	Preset actual value	SV		x	c ¹
05	Actual value in Run mode	QV		x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 5 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.127 Index 0 – Bit I/O

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		—	—	—	—	EN ⁽¹⁾	SE ⁽³⁾	D ⁽⁵⁾	RE ⁽⁷⁾
FB output Data 3		—	—	—	—	ZE ⁽²⁾	CY ⁽⁴⁾	FB ⁽⁶⁾	OF ⁽⁸⁾

(1) Counter enable

(2) Zero: Status 1 if the value of the function block output QV (the counter status) equals zero

(3) Transfer preset actual value on rising edge

(4) Carry: Status 1 if the value range is exceeded

(5) Count direction: 0 = up counting, 1 = down counting

(6) Fall below: Status 1 if the actual value F lower setpoint

(7) Reset actual value to zero

(8) Overflow: Status 1 if the actual value f lower setpoint

Incremental encoder counters: CI01 – CI02

Table 6.128 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	17	17
1	2	Instance	01 – 02	01 – 02
2	3	Index	Table 6.129	Table 6.129
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.130
		Write operation	depending on index, Table 6.130	00

0

Table 6.129 Operand overview

Index (hex)	Operand		Value	read	write
00	Bit IO		Table 6.130	x	
01	Mode/Parameter		–	–	–
02	Upper setpoint	SH	In integer range from –2 147 483 648 to +2 147 483 647	x	c ⁽¹⁾
03	Lower setpoint	SL		x	c ⁽¹⁾
04	Preset actual value	SV		x	c ¹
05	Actual value in Run mode	QV		x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 5 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.130 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	EN ⁽²⁾	SE ⁽⁴⁾	RE ⁽⁶⁾
FB output Data 3		–	–	–	–	ZE ⁽¹⁾	CY ⁽³⁾	FB ⁽⁵⁾	OF ⁽⁷⁾

(1) Zero: Status 1 if the value of the function block output QV (the counter status) equals zero

(2) Counter enable

(3) Carry: Status 1 if the value range is exceeded

(4) Transfer preset actual value on rising edge

(5) Fall below: Status 1 if the actual value F lower setpoint

(6) Reset actual value to zero

(7) Overflow: Status 1 if the actual value f lower setpoint

Comparator: CP01 – CP32

Table 6.131 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	18	18
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.132	Table 6.132

Table 6.131 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.133
		Write operation	depending on index, Table 6.133	00

Table 6.132 Operand Overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.133		x	
01	Mode/Parameter		—	—
02	Comparison value	I1	x	c ⁽¹⁾
03	Comparison value	I2	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 and 3 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.133 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1
FB output Data 3		—	—	—	—	GT ⁽¹⁾	EQ ⁽²⁾	LT ⁽³⁾

(1) greater than: Status 1 if the value at I1 is greater than value at I2 (I1 > I2)

(2) equal: Status 1 if the value at I1 is equal to value at I2 (I1 = I2)

(3) less than: Status 1 if the value at I1 is less than value at I2 (I1 < I2)

Text output function block: D01 – D32

Table 6.134 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	19	19
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.135	Table 6.135
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.136
		Write operation	depending on index, Table 6.136	00

Table 6.135 Operand overview

Index (hex)	Operand	read	write
00	Bit IO, Table 6.136	x	
01	Mode/Parameter	–	–
02	Text line 1, column 1 - 4	x	
03	Text line 1, column 5 - 8	x	
04	Text line 1, column 9 - 12	x	
05	Text line 1, column 13 - 16	x	
06	Text line 2, column 1 - 4	x	
07	Text line 2, column 5 - 8	x	
08	Text line 2, column 9 - 12	x	
09	Text line 2, column 13 - 16	x	
10	Text line 3, column 1 - 4	x	

Table 6.135 Operand overview

Index (hex)	Operand	read	write
11	Text line 3, column 5 - 8	x	
12	Text line 3, column 9 - 12	x	
13	Text line 3, column 13 - 16	x	
14	Text line 4, column 1 - 4	x	
15	Text line 4, column 5 - 8	x	
16	Text line 4, column 9 - 12	x	
17	Text line 4, column 13 - 16	x	
18	Variable 1	x	c ⁽¹⁾
19	Variable 2	x	c ⁽¹⁾
20	Variable 3	x	c ⁽¹⁾
21	Variable 4	x	c ⁽¹⁾
22	Scaling minimum value 1	x	
23	Scaling minimum value 2	x	
24	Scaling minimum value 3	x	
25	Scaling minimum value 4	x	
26	Scaling maximum value 1	x	
27	Scaling maximum value 2	x	
28	Scaling maximum value 3	x	
29	Scaling maximum value 4	x	
30	Control information line 1	x	
31	Control information line 2	x	
32	Control information line 3	x	
33	Control information line 4	x	

1)

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The variables 1 to 4 (index 18 to 21) are transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.136 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	EN ⁽¹⁾
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽²⁾

(1) Text function block enable

(2) Status 1, text function block is active

Data block: DB01 – DB32**Table 6.137 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	1A	1A
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.138	Table 6.138
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.139
		Write operation	depending on index, Table 6.139	00

Table 6.138 Operand overview

Index (hex)	Operand		read	write
00	Bit I0, Table 6.139		x	
01	Mode/Parameter		—	—
02	Input value: value that is transferred to the QV output when the FB is triggered.	I1	x	c ⁽¹⁾
03	Output value	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 and 3 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.139 Index 0 – Bit I0

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		—	—	—	—	—	—	—	T ⁽¹⁾
FB output Data 3		—	—	—	—	—	—	—	Q1 ⁽²⁾

(1) Transfer of the value present at I1 on rising edge.

(2) Status 1 if the trigger signal is 1.

PID controller: DC01 – DC32**Table 6.140 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	—
		Write	B2	—
	0	Response:		
		Read successful	—	C2

Table 6.140 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Write successful	—	C1
		Command rejected	—	C0
0	1	Type	27	27
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.141	Table 6.141
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.142, 6.143
		Write operation	depending on index, Table 6.142, 6.143	

Table 6.141 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.142		x	
01	Mode, 6.143		x	
02	Setpoint: –32768 to +32767	I1	x	c ⁽¹⁾
03	Actual value: –32768 to +32767	I2	x	c ⁽¹⁾
04	Proportional gain [%], Value range: 0 to 65535	KP	x	c ⁽¹⁾
05	Reset time [0.1 s], Value range: 0 to 65535	TN	x	c ⁽¹⁾
06	Rate time [0.1 s], Value range: 0 to 65535	TV	x	c ⁽¹⁾
07	Scan time = Time between function block calls. Value range: 0.1s to 6553.5s. If 0 is entered as the value, the scan time will be determined by the program cycle time.	TC	x	c ⁽¹⁾
08	Manual manipulated variable, value range: –4096 to +4095	M V	x	c ⁽¹⁾
09	Manipulated variable	QV	x	
	<ul style="list-style-type: none"> Mode: UNI, value range: 0 to +4095 (12 bit) Mode: BIP, value range: –4096 to +4095 (13 bit) 			

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 9 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte .. Data 2 - High Byte).

Table 6.142 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	SE ⁽¹⁾	ED ⁽²⁾	EI ⁽³⁾	EP ⁽⁴⁾	EN ⁽⁵⁾
FB output Data 3		–	–	–	–	–	–	–	L ⁽⁶⁾

(1) Transfer of manual manipulated variable on status 1

(2) Activation of D component on status 1

(3) Activation of I component on status 1

(4) Activation of P component on status 1

(5) Activates the function block on status 1.

(6) Status 1 if the value range of the medium-voltage was exceeded

Table 6.143 Index 1 - Mode

Data 1	Mode
UNP unipolar	The manipulated variable is output as a unipolar 12-bit value. Corresponding value range for QV 0 to 4095.
BIP bipolar	The manipulated variable is output as a bipolar 13-bit value. Corresponding value range for QV –4096 to 4095

Signal smoothing filter: FT01 – FT32**Table 6.144 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2

Table 6.144 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	28	28
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.145	Table 6.145
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.146
		Write operation	depending on index, Table 6.146	00

Table 6.145 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.146		x	
01	Mode/Parameter		–	–
02	Input value, value range: –32 768 to +32 767	I1	x	c ⁽¹⁾
03	Recovery time [0.1 s], Value range: 0 to 65535	T G	x	c ⁽¹⁾
04	Proportional gain [%], Value range: 0 to 65535	K P	x	c ⁽¹⁾
05	Delayed output value, value range: –32 768 to +32 767	Q V	x	

(1) The value can only be written if it is assigned to a constant in the program.

Table 6.146 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	EN ⁽¹⁾

(1) Activates the function block on status 1.

Receipt of network data: GT01 – GT32

Table 6.147 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Type	1B	1B
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.148	Table 6.148
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.149 and 6.150

Table 6.148 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.149		x	
01	Mode/Parameters, Table 6.150		x	–
02	Output value: actual value from the network	QV	x	

TIP

The data for index 2 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.149 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	Q ⁽¹⁾

(1) Status 1 if a new value is present that is transferred from the NET network.

Table 6.150 Index 1 – Mode/Parameters (designation of PUT FB with data to be received)

Mode	Data 1	NET-ID ⁽¹⁾	
		0	NET-ID 1
	
		7	NET-ID 8
Parameters	Data 3	Instance ⁽²⁾	
		0	PT01
	
		31	PT32

(1) Number of station sending the value. Possible station numbers: 01 to 08

(2) Send FB (e.g. PT 20) of the sending NET station. Possible station numbers: 01 – 32

7-day time switch: HW01 – HW32

Table 6.151 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Type	1C	1C
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.152	Table 6.152
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.153

Table 6.152 Operand overview

Index (hex)	Operand		read	write
00	Bit IO	Table 6.153	x	
01	Mode/Parameter		–	–
02	Parameters	Table 6.154	x	
	Channel A			
03	Channel B			
04	Channel C			
05	Channel D			

Table 6.153 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	Q ⁽¹⁾

(1) Status 1 if the switch-on condition is fulfilled.

The data in the following table is shown in the Motorola format although it is actually transferred in Intel format.

Table 6.154 Index 2 – 5, Parameter channels A – D

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 2								Date 1							
ON	d4 ⁽¹⁾	d3	d2	d1	d0	h4 ⁽²⁾	h3	h2	h1	h0	m5 ⁽³⁾	m4	m3	m2	m1	m0
	Weekday					Hour					Minute					
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 4								Date 3							
OFF	d4	d3	d2	d1	d0	h4	h3	h2	h1	h0	m5	m4	m3	m2	m1	m0
	Weekday					Hour					Minute					

(1) d5 to d0: Weekday (0 = Sunday to 6 = Saturday)

(2) h4 to h0: Hour (0 to 23)

(3) m5 to m0: Minute (0 to 59)

Example

The channel A parameters of 7-day time switch HW19 are to be read.

Table 6.155

Byte	Meaning	Value (hex), sent by	
		Master	Slave
0	Attribute ID: Read	92	—
	Response: Read successful	—	C2
1	Type	1C	1C
2	Instance	13	13
3	Index	02	02
4	Data 1	00	62
5	Data 2	00	0B
6	Data 3	00	7B
7	Data 4	00	25

Table 6.156 Switch-on Time

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 2 = 0B _{hex}								Date 1 = 62 _{hex}							
ON	0	0	0	0	1	0	1	1	0	1	1	0	0	0	1	0
	Weekday ⁽¹⁾					Hour ⁽²⁾					Minute ⁽³⁾					

(1) Weekday = 01_{hex} .. Monday(2) Hour = 0D_{hex} .. 1300 hours(3) Minute = 22_{hex} .. 34 minutes

Table 6.157 Switch-off Time

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 4 = 25 _{hex}								Date 3 = 7B _{hex}							
OFF	0	0	1	0	0	1	0	1	0	1	1	1	1	0	1	1
	Weekday ⁽¹⁾					Hour ⁽²⁾					Minute ⁽³⁾					

(1) Weekday = 04_{hex} .. Thursday(2) Hour = 15_{hex} .. 2100 hours(3) Minute = 59_{hex} .. 34 minutes

Year time switch: HY01 – HY32

Table 6.158 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Type	1D	1D
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.159	Table 6.159
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.160

Table 6.159 Operand overview

Index (hex)	Operand		read	write
00	Bit IO	Table 6.160	x	
01	Mode/Parameter		–	–
02	Parameters	Table 6.161	x	
	Channel A			
03	Channel B			
04	Channel C			
05	Channel D			

Table 6.160 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	Q ⁽¹⁾

(1) Status 1 if the switch-on condition is fulfilled.

The data in the following table is shown in the Motorola format although it is actually transferred in Intel format.

Table 6.161 Index 2 – 5, Parameter channels A – D

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 2								Date 1							
ON	y6 ⁽¹⁾	y5	y4	y3	y2	y1	y0	m3 ⁽²⁾	m2	m1	m0	d4 ⁽³⁾	d3	d2	d1	d0
	Year								Month				Day			
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 4								Date 3							
OFF	y6	y5	y4	y3	y2	y1	y0	m3	m2	m1	m0	d4	d3	d2	d1	d0
	Year								Month				Day			

(1) y6 ... y0: Year (0: 2000 .. 99: 2099)

(2) m3 ... m0: Month (1 .. 12)

(3) d4 ... d0: Day (1 .. 31)

Example: Index 2 – 5, Parameter channels A – D

The channel A parameters of year time switch HY14 are to be written.

Table 6.162 Switch-on Time

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 2								Date 1							
ON	0	0	0	0	0	1	1	0	1	1	0	0	1	1	1	0
	Year⁽¹⁾								Month⁽²⁾				Day⁽³⁾			

(1) Year = 2003 = 03hex = 0000 0011bin

(2) Month = 6 (June) = 06hex = 0000 0110bin

(3) Day = 14 = 0Ehex = 0000 1110bin

Table 6.163 Switch-off Time

Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
	Date 4								Date 3							
OFF	y6	y5	y4	y3	y2	y1	y0	m3	m2	m1	m0	d4	d3	d2	d1	d0
	Year⁽¹⁾								Month⁽²⁾				Day⁽³⁾			

(1) Year = 2012 = 0Chex = 0000 1100bin

(2) Month = 10 (October) = 0Ahex = 0000 1010bin

(3) Day = 3 = 03hex = 0000 0011bin

Table 6.164 Resulting Telegram

Byte	Meaning	Value (hex), sent by	
		Master	Slave
0	Attribute ID: Write	B2	–
	Response: Write successful	–	C1
1	Type	1D	1D
2	Instance	0E	0E
3	Index	02	02
4	Data 1	8E	00
5	Data 2	06	00
6	Data 3	43	00
7	Data 4	19	00

Value scaling: LS01 – LS32

Table 6.165 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	29	29
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.166	Table 6.166
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.167
		Write operation	depending on index, Table 6.167	

Table 6.166 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.167		x	
01	Mode/Parameter		—	—
02	Input value, value range: 32 bit	I1	x	c ⁽¹⁾
03	Interpolation point 1, X co-ordinate, value range: 32 bit	X1	x	c ⁽¹⁾
04	Interpolation point 1, Y co-ordinate, value range: 32 bit	Y1	x	c ⁽¹⁾
05	Interpolation point 2, X co-ordinate, value range: 32 bit	X2	x	c ⁽¹⁾
06	Interpolation point 2, Y co-ordinate, value range: 32 bit	Y2	x	c ⁽¹⁾
07	Output value: contains the scaled input value	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

Table 6.167 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		—	—	—	—	—	—	—	EN ⁽¹⁾

(1) Activates the function block on status 1.

Master reset: MR01 – MR32

Table 6.168 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	—
	0	Response:		
		Read successful	—	C2
		Command rejected	—	C0

Table 6.168 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
0	1	Type	0F	0F
1	2	Instance	01 – 20	01 – 20
2	3	Index		
		Bit IO	00	00
		Mode	01	01
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.169, 6.170

Table 6.169 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	T ⁽¹⁾
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽²⁾

(1) Trigger coil. The appropriate Reset is executed if the coil is triggered (with a rising edge).

(2) Status 1 if the trigger coil MR..T is 1.

Table 6.170 Index 1 - Mode

Data 1 (hex)		
00	Q	Outputs Q., *Q., S., *S., *SN., QA01 are reset to 0. * depending on the NET-ID
01	m	The marker range MD01 to MD48 is reset to 0.
02	ALL	Has an effect on Q and M.

Numerical converter: NC01 – NC32

Table 6.171 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–

Table 6.171 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	A 2	A 2
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.172	Table 6.172
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.173, 6.174
		Write operation	depending on index, Table 6.173, 6.174	00

Table 6.172 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.173		x	
01	Mode, Table 6.174		x	
02	Input value: operand to be converted	I1	x	c ⁽¹⁾
03	Output value: contains the conversion result	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 and 3 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte .. Data 2 - High Byte).

Table 6.173 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	EN ⁽¹⁾

(1) Activates the function block on status 1.

Table 6.174 Index 1 - Mode

Data 1 (hex)		
00	BCD	Converts a BCD coded decimal value to an integer value.
01	BIN	Converts an integer value to a BCD coded decimal value.

Hours-run meters: OT01 – OT04

h

Further information is available in the S40 Application Note AN27K21g.exe "Pico GFX-DP Data Handling Function Block for PS416 and PS4-341".

*Telegram structure***Table 6.175 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	—
		Write	B2	—
	0	Response:		
		Read successful	—	C2
		Write successful	—	C1
		Command rejected	—	C0
0	1	Type	1E	1E
1	2	Instance	01 – 04	01 – 04
2	3	Index	Table 6.176	Table 6.176
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.177
		Write operation	depending on index, Table 6.177	00

Table 6.176 Operand overview

Index (hex)	Operand		read	write
00	Bit I0, Table 6.177		x	
01	Mode/Parameter		—	—
02	Upper threshold value	I1	x	c ⁽¹⁾
03	Actual value of operating hours counter	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

Table 6.177 Index 0 – Bit I0

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		—	—	—	—	—	—	RE ⁽¹⁾	EN ⁽²⁾
FB output Data 3		—	—	—	—	—	—	—	Q1 ⁽³⁾

(1) Reset coil: Status 1 resets the counter actual value to zero.

(2) Enable coil

(3) Status 1 if the setpoint was reached (greater than/equal to)

TIP

The data for index 2 and 3 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Sending of network data: PT01 – PT32**Table 6.178 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	—
	0	Response:		
		Read successful	—	C2
		Command rejected	—	C0
0	1	Type	1F	1F

Table 6.178 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.179	Table 6.179
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.180

Table 6.179 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.180		x	
01	Mode/Parameter		–	–
02	Input value: Setpoint that it transmitted to the NET network	l1	x	

TIP

The data for index 2 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.180 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	T ⁽¹⁾
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽²⁾

(1) Trigger coil. The value is provided on the NET if the coil is triggered (with a rising edge).

(2) Status 1 if the trigger coil PT..T_ is also 1.

Pulse width modulation: PW01 – PW02

Table 6.181 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	2B	2B
1	2	Instance	01 – 02	01 – 02
2	3	Index	Table 6.182	Table 6.182
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.183
		Write operation	depending on index, Table 6.183	00

Table 6.182 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.183		x	
01	Mode/Parameter		–	–
02	Manipulated variable, value range: 0 to 4095 (12 bit)	SV	x	c ⁽¹⁾
03	Period duration [ms], Value range: 0 to 65535	PD	x	c ⁽¹⁾
04	Minimum on duration [ms], Value range: 0 to 65535	M E	x	c ⁽¹⁾

(1) The value can only be written if it is assigned to a constant in the program.

Table 6.183 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	EN ⁽¹⁾
FB output Data 3		–	–	–	–	–	–	–	E1 ⁽²⁾

(1) Activates the function block on status 1.

(2) Status 1 if below the minimum on duration or minimum off duration

Synchronize clock function block: SC01

Table 6.184 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID: Read	92	–
	0	Response:		
		Read successful	–	C2
		Command rejected	–	C0
0	1	Type	20	20
1	2	Instance	01	01
2	3	Index	Table 6.185	Table 6.185
3 – 6	4 – 7	Data 1 – 4	00	depending on index, Table 6.186

Table 6.185 Operand overview

Index (hex)	Operand	read	write
00	Bit IO, Table 6.186	x	
01	Mode/Parameter	–	–

Table 6.186 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	–	–	T ⁽¹⁾
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽²⁾

- (1) Trigger coil. If the coil is triggered (rising edge), the current date, weekday and time of the sending station are automatically sent to the NET network.
- (2) Status 1 if the trigger coil SC01T_ is also 1.

Set cycle time function block: ST01

Table 6.187 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	—
		Write	B2	—
	0	Response:		
		Read successful	—	C2
		Write successful	—	C1
		Command rejected	—	C0
0	1	Type	2C	2C
1	2	Instance	01	01
2	3	Index	Table 6.188	Table 6.188
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.189
		Write operation	depending on index, Table 6.189	00

Table 6.188 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.189		x	
01	Mode/Parameter		—	—
02	Cycle time in ms, value range: 0 – 1000	I1	x	c ⁽¹⁾

- (1) The value can only be written if it is assigned to a constant in the program.

Table 6.189 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		–	–	–	–	–	–	–	EN ⁽¹⁾

(1) Activates the function block on status 1.

Timing relays: T01 – T32

Table 6.190 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	21	21
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.191	Table 6.191
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.192, 6.193
		Write operation	depending on index, Table 6.192, 6.193	

Table 6.191 Operand overview

Index (hex)	Operand		read	write
00	Bit IO, Table 6.192		x	
01	Mode/Parameters, Table 6.193		x	

Table 6.191 Operand overview

Index (hex)	Operand		read	write
02	Setpoint 1: Time setpoint 1	I1	x	c ⁽¹⁾
03	Setpoint 2: Time setpoint 2 (with timing relay with 2 setpoints)	I2	x	c ⁽¹⁾
04	Actual value: Time elapsed in Run mode	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

TIP

The data for index 2 to 4 is transferred as a 32-bit value in Intel format (Data 1 – Low Byte to Data 4 – High Byte).

Table 6.192 Index 0 – Bit IO

	Bit	7	6	5	4	3	2	1	0
FB input Data 1		–	–	–	–	–	ST ⁽¹⁾	EN ⁽²⁾	RE ⁽³⁾
FB output Data 3		–	–	–	–	–	–	–	Q1 ⁽⁴⁾

(1) Stop, the timing relay is stopped (Stop coil)

(2) Enable, the timing relay is started (trigger coil)

(3) Reset, the timing relay is reset (reset coil)

(4) Switch contact

Table 6.193 Index 1 - Mode/Parameters

Mode	Data 1	Mode
	0	On-delayed,
	1	On-delayed with random setpoint
	2	off-delayed.
	3	Off-delayed with random setpoint
	4	On and off delayed (two time setpoints)
	5	On and off delayed each with random setpoint (two time setpoints)
	6	Impulse transmitter
	7	Flashing relay (two time setpoints)
	8	Off-delayed, retriggerable
	9	Off-delayed with random setpoint, retriggerable
Parameters	Data 3	Mode
	0	S (milliseconds)
	1	M:S (seconds)
	2	H:M (minutes)

Value limitation: VC01 – VC32**Table 6.194 Telegram Structure**

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
		Attribute ID		
		Read	92	–
		Write	B2	–
	0	Response:		
		Read successful	–	C2
		Write successful	–	C1
		Command rejected	–	C0
0	1	Type	2D	2D
1	2	Instance	01 – 20	01 – 20
2	3	Index	Table 6.195	Table 6.195

Table 6.194 Telegram Structure

Byte		Meaning	Value (hex), sent by	
Master	Slave		Master	Slave
3 – 6	4 – 7	Data 1 – 4		
		Read operation	00	depending on index, Table 6.196
		Write operation	depending on index, Table 6.196	00

Table 6.195 Operand overview

Index (hex)	Operand		read	write
00	Bit I0, Table 6.196		x	
01	Mode/Parameter		—	—
02	Input value	I1	x	c ⁽¹⁾
03	Upper limit value	SH	x	c ¹
04	Lower limit value	SL	x	c ¹
05	Output value: outputs the value present at input I1 within the set limits.	QV	x	

(1) The value can only be written if it is assigned to a constant in the program.

Table 6.196 Index 0 – Bit I0

	Bit	7	6	5	4	3	2	1	0
FB output Data 3		—	—	—	—	—	—	—	EN ⁽¹⁾

(1) Activates the function block on status 1.

Analysis – error codes via PicoLink

The Pico GFX basic unit will return a defined error code in the event of an incorrectly selected operating mode or an invalid telegram. The error code transferred has the following structure:

Table 6.197 Telegram Structure

Byte	Meaning	Slave transmits (value hex)
0	Answer	
	Command rejected	C0
1	Type	
2	Instance	
3	Index	
4	Error code	Table 6.198
5 – 7	Data 2 – 4	

Table 6.198 Error codes

Error code	Description
0x00	no error
0x03	formal fault in the response relating to type, instance or index
0x04	no communication possible (timeout)
0x05	DP module has only sent 0xC0 (Pico GFX Basic II, GFX version I).
0x45	the value selected by the type and index may not be written (bit IO, mode/parameter or output value).
0x46	the value selected by the type and index is not assigned with a constant.
0x9E	access to the FB data not possible (program download active).
0x9F	type is invalid (no defined FB, also dependant on the version of the addressed device).
0xA0	FB selected by type and instance does not exist in program.
0xA1	index relative to the defined FB type is invalid

Troubleshoot Your Controller

Table 8.199

Module Status LED MS	Possible Cause	Correction
OFF	No power at module.	Switch on the power supply.
Green	module is in standby mode.	None
Green flashing	module not configured.	Verify the correct setting of the MAC ID.
Red flashing	Invalid configuration	Check configuration data.
RED	Module error which can not be resolved.	Replace the module.

Table 8.200

Network Status LED NS	Possible Cause	Correction
OFF	module without power or communication is blocked at this channel because of bus-off state or power loss or the channel was blocked explicitly.	Switch on the module, supply the mains voltage to the channel and ensure that the channel is active.
Green	Although the channel is enabled, communication is not possible.	Check the communication function at the master programmable controller.
Green flashing	Normal mode	None
Red flashing	Communication error or the module may be defective.	Reset the module. If further errors occur, replace the module.
RED	Communication error.	Check the master programmable controller.

Specifications

Technical Data

Table 1.1 General Specifications

Description	Specification
Standards and regulations	EN 61000-6-1; EN 61000-6-2; EN 61000-6-3; EN 61000-6-4, IEC 60068-2-27, IEC 50178
Dimensions W x H x D	35.5 x 90 x 56.5 mm
Weight	150 g
Mounting	DIN 50022 rail, 35 mm screw fixing with fixing bracket ZB4-101-GF1 (accessories)

Table 1.2 Climatic environmental conditions (Cold to IEC 60068-2-1, Heat to IEC 60068-2-2)

Description	Specification
Ambient temperature Installed horizontally/vertically	−25 to +55 °C
Condensation	Prevent condensation with suitable measures
Storage/transport temperature	−40 to +70 °C
Relative humidity (IEC 60068-2-30), no moisture condensation	5 to 95 %
Air pressure (operation)	795 to 1080 hPa
Corrosion resistance (IEC 60068-2-42, IEC 60068-2-43)	SO ₂ 10 cm ³ /m ³ , 4 days H ₂ S 1 cm ³ /m ³ , 4 days

Table A.3 Mechanical Ambient Conditions

Description	Specification
Pollution degree	2
Degree of protection (EN 50178, IEC 60529, VBG4)	IP20
Vibration (IEC 60068-2-6) constant amplitude 0.15 mm	10 to 57 Hz
Vibration (IEC 60068-2-6) constant acceleration 2 g	57 to 150 Hz

Table A.3 Mechanical Ambient Conditions

Description	Specification
Shocks (IEC 60068-2-27) semi-sinusoidal 15 g/11 ms	18 Shocks
Drop (IEC 60068-2-31) height	50 mm
Free fall, when packed (IEC 60068-2-32)	1 m

Table A.4 Electromagnetic Compatibility (EMC)

Description	Specification
Electrostatic discharge (ESD), (IEC/EN 61000-4-2, severity level 3) Air discharge	8 kV
Electrostatic discharge (ESD), (IEC/EN 61000-4-2, severity level 3) Contact discharge	6 kV
Electromagnetic fields RFI), (IEC/EN 61000-3	10 V/m
Radio interference suppression (EN 55011, EN 55022), class	B
Burst (IEC/EN 61000-4-4, severity level 3) Power cables	2 kV
Burst (IEC/EN 61000-4-4, severity level 3) Signal cables	2 kV
High energy pulses (Surge) (IEC/EN 61000-4-5), power cable symmetrical	1 kV
High-energy pulses (surge) of DC current (IEC/EN 61 000-4-5, severity level 2), power cable symmetrical	0.5 kV
Line-conducted interference (IEC/EN 61000-4-6)	10 V

Table A.5 Dielectric Strength

Description	Specification
Measurement of the clearance and creepage distance	EN 50178, UL508, CSA C22.2 No. 142
Dielectric strength	EN 50 178

Table A.6 Tools and Cable Cross-Sections

Description	Specification
Conductor cross-sections Solid, minimum to maximum	0.2 to 4 mm ² , 22 to 12 AWG
Conductor cross-sections Flexible with ferrule, minimum to maximum	0.2 to 2.5 mm ² , 22 to 12 AWG
Slot-head screwdriver, width	3.5 x 0.8 mm
Tightening torque	0.5 Nm

Table A.7 Power Supply

Description	Specification
Rated Voltage Value	24V dc
Rated Voltage Range	20.4 ... 28.8V dc
Rated Voltage Residual Ripple	<5 %
Rated Voltage Input Current at 24V dc, typical	200 mA
Rated Voltage Dips, IEC/EN 61131-2	10 ms
Rated Voltage Power Loss at 24V dc typical	4.8 W

Table A.8 LED Displays

LED	Color
Module Status LED MS	Green/Red
Network Status LED NS	Green/Red

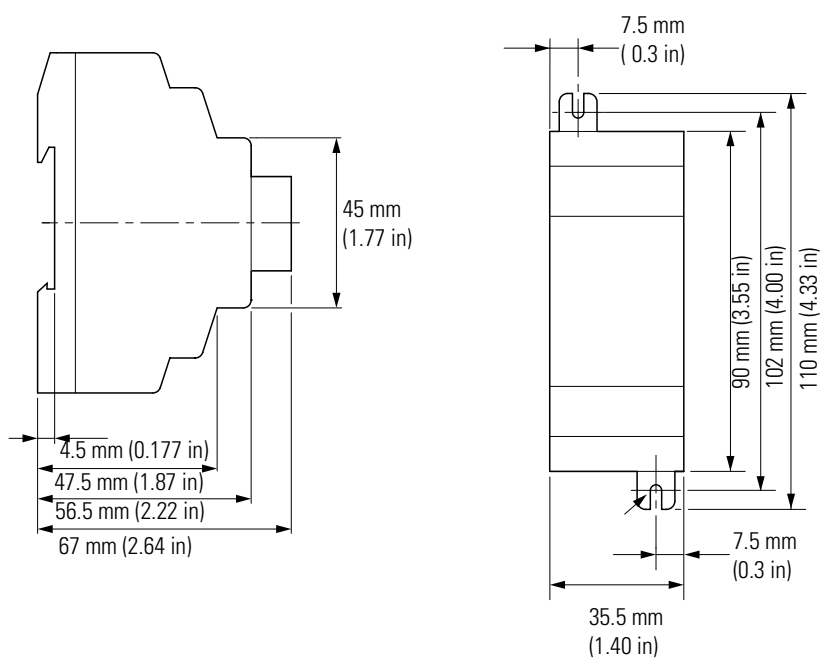
Table A.9 DeviceNet

Description	Specification
Device connection	5-pole socket
Electrical isolation	Bus to power supply (simple) Bus and power supply to basic unit (safety isolation)
Function	DeviceNetSlave
INTERFACE	DeviceNet (CAN)
Bus protocol	DeviceNet
Baud rate, automatic detection up to	500 kbps

Table A.9 DeviceNet

Description	Specification
Bus termination resistors	Separate installation at the bus possible
Bus addresses, accessible via basic unit with display or Pico-SOFT	0 to 63
Services: Module inputs	all data S1 to S8 (Pico Series B)
Services: Module outputs	all data R1 to R16 (Pico Series B)
Services: Module control commands	Read/Write Weekday, time-of-day, summer/winter time All parameters of the Pico functions

Dimensions

Figure 1.1 1760-DNET dimensions in [mm]

Terminating Resistor

Terminating resistor at the start and end of a bus cable. Prevents interference due to signal reflection and is used for the adaptation of bus cables. Bus terminating resistors must always be the last unit at the end of a bus segment.

Acknowledge

Acknowledgement returned by the receiving station after having received a signal.

Address

Number that identifies a memory area, systems or module within a network, for example.

Addressing

Assignment or setting of an address for a module in the network, for example.

Active metallic component

Conductor or conductive component that is live when in operation.

Analogue

Value, such as voltage, that is infinitely variable and proportional. Analogue signals can acquire any value within specific limits.

Automation product

I/O controlling device that is interconnected to a system process. Programmable controllers represent a special group of automation products.

Baud

Unit for the data transfer rate. One baud is equivalent to the transmission of one bit per second (bps).

Baud rate

Unit of measure of the data transmission speed in bit/s.

Electrical equipment

Comprises all equipment used for the generation, conversion, transfer, distribution and application of electrical energy, e.g. power lines, cables, machines, controllers.

Reference ground

Earth potential in the area of grounding devices. May have a potential other than the zero of "earth" potential.

Reference potential

Represents a reference point for measuring and/or visualising the voltage of any connected electrical circuits.

Bidirectional

Operation in both directions.

Bit

Abbreviation for the term "binary digit". Represents the smallest information unit of a binary system. Its significance can be 1 or 0 (Yes/No decision).

Lightning protection

Represents all measures for preventing system damage due to overvoltage caused by lightning strike.

Bus

Bus system for data exchange, for example between the CPU, memory and I/O. A bus can consist of several parallel segments, e.g. the data bus, address bus, control bus and power supply bus.

Bus line

Smallest unit connected to the bus. Consists of the programmable controller, a module and a bus interface for the module.

Bus system

All units as a whole which communicate across a bus.

Bus cycle time

Time interval in which a master provides services to all slaves or nodes of a bus system, i.e. writes data to their outputs and reads inputs.

Byte

A sequence of 8 bits

Code

Data transfer format

COS I/O connection

COS (Change Of State) I/O connections are used to set up event-controlled connections, i.e. the DeviceNet devices automatically generate messages when a status has changed.

2 byte diagnostics data of the control relay

Coupling module status

CPU

Abbreviation for "Central Processing Unit". Central unit for data processing. Represents the core element of a computer.

Cyclic I/O connection

Message triggering is timer-controlled when operating with a cyclic I/O connection.

Device Heartbeat Message

A DeviceNet unit can use the Device Heartbeat Message function to broadcast its native status at set time intervals. These messages are configured in the Identity Object.

Device Shut Down Message

A device shutting down due to internal errors or states can log off at the programmable controller by means of the Device Shut Down Message.

Digital

Represents a value that can acquire only definite states within a finite set, e.g. a voltage. Mostly defined as "0" and "1".

DIN

Abbreviation for "Deutsches Institut für Normungen e. V.".

Dual Code

Natural binary code. Frequently used code for absolute measurement systems.

EDS

This EDS file primarily defines the Polled I/O Connection, the COS I/O Connection and the Cyclic I/O Connection of the gateway. It does not contain data or parameters (Pico object) for functions of the basic unit. These functions are accessed by means of explicit messages.

EEPROM

Abbreviation for "Electrically Erasable Programmable Read-only Memory".

EMC

Abbreviation for "Electromagnetic Compatibility". Defines the ability of electrical equipment to operate error-free and without causing a negative influence within a certain environment.

EN

Abbreviation for "European Norm".

Earth

Defines in electrical engineering the conductive earth whose electrical potential is equal to zero at any point. The electrical potential in the area of earthing devices might not be equal to zero. In this case, one refers to "Reference ground".

Earthing

Represents the connection of an electrically conductive component to the equipotential earth via a grounding device.

Earth electrode

One or several components with direct and good contact to earth.

ESD

Abbreviation for "Electrostatic Discharge".

Fieldbus

Data network on the sensor/actuator level. The fieldbus interconnects the devices at field level. Characteristic feature of the fieldbus is the highly reliable transfer of signals and real-time response.

Field power supply

Power supply for the field devices and signal voltage.

Galvanic coupling

Galvanic coupling generally develops between two circuits using a common cable. Typical interference sources are starting motors, static discharge, clocked devices and potential difference between the component enclosure and their common power supply.

GND

Abbreviation for "GROUND" (zero potential).

hexadecimal

Numerical system with the base 16. The count starts at 0 to 9 and continues with the letters A, B, C, D, E and F.

I/O

Abbreviation for "Input/Output".

Impedance

Alternating current-resistance of a component or of a circuit consisting of several components at a specific frequency.

Low-impedance connection

Connection with low alternating-current resistance.

Inactive metallic parts

Touch-protected conductive components, isolated electrically from active metallic parts by means of an insulation, but subject to fault-voltage.

Inductive coupling

Inductive (magnetic) coupling develops between two current-carrying conductors. The magnetic effect generated by the currents induces an interference voltage. Typical interference sources are, for example

transformers, motors, mains cables installed parallel and RF signal cables.

Capacitive coupling

Capacitive (electrical) coupling develops between two conductors carrying different potentials. Typical interference sources are, for example parallel signal cables, contactor relays and static discharge.

Coding element

Two-part element for the unambiguous allocation of electronic and basic module.

Command modules

Command-capable modules are modules with an internal memory that are capable of executing particular commands (such as output substitute values).

CONFIGURE...

Systematic arrangement of the I/O modules of a station.

Protected against short-circuit

Property of electrical equipment. Short-circuit-proof equipment has the ability to withstand the thermal and dynamic loads that may occur at the location of installation on account of a short-circuit.

LSB

Abbreviation for "Least Significant Bit". Bit with the least significant value.

Chassis ground

All interconnected inactive equipment parts which are not subject to hazardous fault voltage.

Earthing tape

Flexible conductor, mostly braided. Interconnects inactive parts of equipment, e.g. the doors of a control panel and the switch cabinet body.

Master

Station or node in a bus system that controls communication between the other stations of the bus system.

Master/Slave Mode

Operating mode in which a station or node of the system acts as master that controls communication on the bus.

Mode

Operating mode.

Module bus

Represents the internal bus of an XI/ON station. Used by the XI/ON modules for communication with the gateway. Independent of the fieldbus.

MSB

Abbreviation for "Most Significant Bit". Bit with the most significant value.

Multimaster Mode

Operating mode in which all stations or nodes of a system have equal rights for communicating on the bus.

NAMUR

Abbreviation for "Normen-Arbeitsgemeinschaft für Mess- und Regeltechnik". NAMUR proximity switches represent a special category of 2-wire proximity switches. They are highly resistant to interference and reliable due to their special construction, e.g. low internal resistance, few components and short design.

Offline Connection Set

The Offline Connection Set allows communication with a device that is in communication error state but not in bus-off state due to an ambiguous address. It is usually no longer possible to address this device on the network, and it must be initialised manually by switching it off and on. The Offline Connection Set can be used in this situation to address such a device on the network.

Overhead

System management time. Required once for each data transfer cycle.

Parameter assignment

Definition of parameters for individual bus stations or their modules in the configuration software of the DeviceNet master.

Polled I/O connection

A polled I/O connection is used to establish a conventional master/slave relation between a programmable controller and a DeviceNet device, and represents a PtP connection between two stations on the fieldbus. The master (client) transmits a polling request to the slave (server), and this answers with a polling response.

- 3 bytes of output data
S1 to S8
Pico/GFX output range, RUN/STOP
(inputs at the DeviceNet master)
- 3 bytes of input data
R1 to R16
Pico/GFX input range, RUN/STOP (outputs of the DeviceNet master)

Equipotential bonding

Adaptation of the electrical level of the body of electrical equipment and auxiliary conductive bodies by means of an electrical connection.

Potential-free

Galvanic isolation between the reference potentials of the control and load circuit of I/O modules.

Common potential

Electrical interconnection of the reference potentials of the control and load circuit of I/O modules.

Response time

In a bus system this represents the time interval between the transmission of a read request and receiving the answer. Within an input module, it represents the time interval between the signal change at an input and its output to the bus system.

Repeater

Amplifier for signals transferred across a bus.

Screen

Term that describes the conductive covering of cables, cubicles and cabinets.

Shielding

Refers to all measures and equipment used to connect system parts to the screen.

Protective conductor

Conductor required for human body protection against hazardous currents. Abbreviation: PE ("Protective Earth").

Serial

Describes an information transfer technique. Data are transferred in a bit-stream across the cables.

Slave

Station or node in a bus system that is subordinate to the master.

Station

Function unit or module, consisting of several elements.

Noise emission (EMC)

Testing procedure to EN 61000-6-4

Noise immunity (EMC)

Testing procedure to EN 61000-6-2

Radiation coupling

Radiated coupling occurs when an electromagnetic wave makes contact with a conductor structure. The impact of the wave induces currents and voltages. Typical interference sources are, for example ignition circuits (spark plugs, commutators of electrical motors) and transmitters (e.g. radio-operated devices), which are operated near the corresponding conductor structure.

Topology

Geometrical network structure, or circuit arrangement.

UART

Abbreviation for "Universal Asynchronous Receiver/Transmitter". A "UART" represents a logical circuit used to convert an asynchronous serial data stream into a parallel bit stream and vice versa.

UCMM

The DeviceNet gateway provides an option of configuring dynamic connection objects via the UCMM port (Unconnected Message Manager Port).

Unidirectional

Operating in one direction.

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